

NASA CR-65980

NAS 9-4874

## EVALUATION OF THE THERMAL PROPERTIES OF MATERIALS

Prepared by

Avco Corporation  
Avco Space Systems Division  
Lowell, Massachusetts

AVSSD 0197-66-RR

NAS 9-4874

Volume II: Data Handbook

Final Report

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16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33		
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(CODE)	33	
(CATEGORY)		



Prepared for

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
MANNED SPACECRAFT CENTER  
2101 Webster -Seabrook Road  
Houston, Texas 77058

NASA CR 65980

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This document consists of 233 pages,  
155 copies, Series A

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APPROVED

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FOREWORD

This report is the second volume of a three volume series prepared by Avco Corporation, Space Systems Division under NASA MSC Contract Number NAS 94874 dated June 29, 1965. Time period of performance was June 29, 1965 to June 28, 1966.

The program was managed by Michael E. Ihnat of the Materials Development Department, Avco Corporation, Space Systems Division and the technical monitor for the National Aeronautics and Space Administration, Manned Spacecraft Center, Houston, Texas, was John Orsag of the Structures and Mechanics Branch.

The second volume of this report, was prepared to make the data, its analysis and correlations, more useful for engineering designers. The volume has been organized to be used separately from the other volumes, with the exception that details of techniques used in obtaining the test data are discussed in Volume I. Presenting the data as a separate volume, removed from apparatus discussions, should have the additional advantage of drawing into focus the overall report. Toward that end and, specifically, to clarify limitations of application, this volume includes, where appropriate, discussions of test-materials peculiarities when subjected to various test environments.

Although program duration did not permit a complete investigation of unexpected phenomena affecting material properties and application, cursory evaluations did provide insight into problem areas, and, for those intimately interested with the material, suggested approaches for future studies.

To assist in data location, index tabs have been inserted between major data categories.

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ABSTRACT

Volume II is essentially a compilation of all test data obtained from the experiments described in Volume I. In addition to both tabular and graphic illustrations of the results, included are critical comments related to material peculiarities when subjected to the various test environments. Arrangement of the information is according to material groups i.e., structural material, ablators, adhesives and seals, and insulations.

The format and contents of volume two enable the user to more easily obtain the materials properties by the exclusion of the bulk of test descriptions and methods outlined in Volume I.

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## 1.0 INTRODUCTION

This program was primarily directed toward the study of aluminum honeycomb panel structures and Avco Ablator 5026-39. Because of data variation between panels, core depth, foil size, cell size, adhesive bond, node bond, and fabrication processes, a final analysis of the aluminum honeycomb data had to be iterative: experimental statistics were insufficient to separate each variable, and a program providing these statistics was economically prohibitive. In some instances, where it was expected that correlation analysis would not be influenced by the testing of a complete series over the entire test range, the study was concentrated on temperature ranges where a different mode of heat transfer was expected to occur. This would seem to be of greater value to the overall program; and necessary correlation curves could be obtained from data cross plots.

When it is felt that phenomena occurring has not been sufficiently examined, recommendations are presented for further analyses. In some instances, because of the introduction of heat-transfer-mode variations, these phenomena could affect the materials during a mission.

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## 2.0 TECHNICAL DISCUSSION

### 2.1 ALUMINUM HONEYCOMB PANELS: CORRELATION CURVES

Figures 1 through 9 present the apparent thermal conductivity and the variability of the test data points as a function of panel thickness. Constancy between samples cut from panels of constant core depth was good; variation was significant, however, between panels of different core depths. Core-depth variation was attributed to variations from nominal foil thickness, although other factors could be significant. It was verified that most of the cores were on the plus side of the nominal thickness, in the heavier foils by as much as 30-percent. During the course of several meetings with the vendor, the laboratory was also informed that the heavier foils contain different node adhesives. The main reason for this variation was determined the result of the specification criteria that included strength characteristics but not thermophysical property limits.

#### 2.1.1 Test Data: Aluminum Honeycomb

Figures 10 through 44 present the individual test data of thermal conductance as a function of temperature at atmospheric pressure for all of the aluminum honeycomb sandwich panels tested. Figures 45 through 52 show results on the same materials tested in a vacuum environment. The level of pressure during vacuum tests is indicated above each data point to show what is assumed to be the effect of vaporization of either the HT 424 or the node bond adhesive vaporizing into the cells. At moderately low pressures, the various levels indicate the lowest pressure that could be obtained using only the roughing pump of the vacuum system. In each instance, the pressure levels were observed for minimum periods of 14 hours and when the samples indicated pressure stability. Following the initial 14 hours of pumping at room temperature, a re-run of some samples revealed that the system was further stabilized and that the data curve changed (Figure 45). The pressures on re-runs decreased somewhat, not as significantly, however, as on the first run. Figures 46 and 47 are tests at  $10^{-4}$  torr. In these tests, as expected, assuming sample stability, neither the level of conductance nor the curve configurations changed.

Apparent thermal conductivity variation with pressure data shows a consistent decrease with pressure, i.e., a factor of four when pressure is reduced from atmospheric to a vacuum; also, conductivity increases with temperature, regardless of ambient pressure.

By comparison, the conductivity of stainless steel panels reduces with pressure (atmospheric to vacuum) by a factor of two and remains relatively constant with temperature, regardless of pressure.

All tests described above were made on panels fabricated by the Albano Co. of New York. Figures 53 and 54 are the results of tests performed at atmospheric pressure on a NASA-MSC supplied material having a 0.96-inch core depth, a 3/16-inch cell, and a 0.0015-inch foil, and assumed to be of 5052-H39 alloy. There was material supplied for only one set of samples; as a result, all tests were performed sequentially. The low-temperature series of three tests was made before the normal temperature range was measured. These precautions were taken as not to deteriorate the HT 424 interface before the next test could be performed. It appears that cyclic tests on a single set of specimens tend to alter the shape of the thermal-conductance - temperature curve. This variation should be examined more carefully.

Previous curves show high-temperature characteristics that cannot be attributed to radiation transport. The only apparent conclusion is that heat transfer by convection occurs. The convective component has been attributed to either the decomposition of HT 424 or of the node-bond adhesive or both.

Visual observations of the HT 424 interface layer found a difference in overall appearance and texture. Consultations with adhesive specialists confirm that the cure cycle and temperature could cause a variety of HT 424 characteristics. (See figures 55 and 56. )

To determine the amount of anisotropy present, two tests were conducted on samples of core material alone. Core specifications for these specimens were 5052-H39, 3/16-inch cells and 0.001-inch foil. In these tests, heat-flow direction was as shown in Figure 57. To avoid interface temperature gradients between the heater plates and specimens, thermocouple instrumentation required in the tests were fixed directly to the foil edges. The data obtained from the measurements are included in the general data tabulation in the appendix of this volume and are illustrated in Figure 57. The only conclusion that could be made from the limited testing was that when heat flow is parallel to the node-bond plane the conductance of the material is higher by a factor of 2 1/2 than when heat flow is perpendicular to the node-bond plane.

Table I presents a summary of the tests as derived from analysis of the raw data and a calculation of an arithmetic mean and a standard deviation. Table II uses the data of the previous Table; calculations of the first-order equations are presented for each panel type measured during the program.

## 2.2 STAINLESS STEEL HONEYCOMB SANDWICH PANELS

Although, at the request of NASA-MSC, the stainless-steel honeycomb investigation was on a reduced scale, it was evident from the aluminum-honeycomb investigation that a more extensive stainless-steel study is needed. This need is the result of all honeycomb panels being mechanically specified without apparent consideration of thermal aspects. High-speed-flight and reentry application make the thermal aspect more important now than previous applications.

Figures 58 through 60 are the results of testing at atmospheric pressure on one-piece specimens (TS 501) having 0.008-inch face plates. These figures show test repeatability by presenting the results of three consecutive runs. The repeatability variation is small. Figures 61 and 62 are for the same materials, with the exception that these results are from two-piece specimens. In all of these figures where low temperature results are included, the scatter of data increases significantly. Operational verification tests were performed. The results are as presented, and further inquiries are needed to explain these variations. Figure 62 illustrates all the tests performed at atmospheric pressure on two-piece specimens (TS 513) where the face plate was 0.015-inch.

Figure 63 illustrates test results that have not been presented in separate curve form because they were taken at a nearly constant mean temperature while reducing the pressure. The figure exhibits no peculiarities; the decrease in apparent thermal conductivity is what would be normally expected, i. e., changes to  $10^{-3}$  torr, where the mean free path (1.97 inches) of entrapped air is sufficiently long to reduce essentially to zero conduction through the void space. No further conductivity variation due to conduction would result were the pressure reduced to lower values unless another mode of heat transfer occurred.

Table III is an analysis of the stainless-steel data obtained by determining the arithmetic mean and standard deviation of all tests. Table IV presents the first-order equation determined from an analysis and the data of Table III. The table shows that the variation of the face plate does not affect test results. Intermediate data showed that the standard deviation was greater for the thinner face plates. It was determined that the higher standard deviation for the thinner face plates was because of the irregularity of the surface; grinding to test-sample specifications was impracticable because of the depression of the face plates into the core voids.

## 2.3 ABLATORS

### 2.3.1 Primary

Ablators were defined as materials, other than ascent protective covers, that would be located on the external reentry surfaces of the spacecraft. Many ablators were considered during the program; some were classed as charring and others as subliming. The experimental effort was moderately extensive, data analysis being primary.

Measurement of the thermophysical properties of charring ablators is complicated by the several states of materials that can exist while substrates undergo decomposition during reentry. Decomposition of substrates causes residue percolation, gaseous transpiration, radiation in depth, and continuous changes of material state.

The procedures of evaluating these types of materials were discussed in Volume I. The problem in test-data analysis remains to be the determining of verifiable measurements using steady-state techniques and their application to transient conditions. The design engineer must be provided with the best data correlations and variation explanations enclosed on the primary parameters and other support data.

The next problem in thermophysical measurements is the securing of design values that can be used in lieu of measurements at the very extreme temperatures where steady-state and transient measurements are either difficult or unreliable or fail completely.

Figure 64 shows a correlation resulting from measuring the charring ablator (Avcoat 5026-39). Avcoat 5026-39 is a proprietary material of the Avco Corporation and was one of the ablators evaluated under this contract. That the curve family of the figure contains some pattern indicates that a correlation with other parameters is possible. Postulations up to the sublimation temperature are also possible; these, however, would have to be deduced from materials assumed to exist at the elevated temperatures. Tables V and VI present apparent thermal conductivity and specific heat at several temperatures both for virgin and charred Avcoat 5026-39. This information was obtained from

Tables VII and VIII, which list the raw data from the various tests. Figure 65 and 66 illustrates variations as a function of temperature for various states of Avcoat 5026-39. Figure 66 shows that a significant variation can occur from tests at the same prechar temperature. Figure 67 and the Figures discussed above consolidate all the Avcoat 5026-39 measurements. Figure 67 represent virgin ablator variation with density.

During the contract, it was suggested that consideration be given to the heat-of-decomposition measurements. These were performed and are reported in Table IX. With a residue analysis, the study could have provided more information for understanding the parametric variations and contributed significantly to an understanding of Avcoat 5026-39 ablation conditions. These analyses would have also been significant to further analysis of Figure 64. Time did not permit completion of these experiments.

### 2. 3. 2 Other Materials, Ablator

The following series of materials are presented without specific catagories since, in most instances, limited data was obtained. They do, however, fulfill contract requirements. Figures 68 and 69 are the results of two thermal conductivity tests of the NASA-Langley Purple Blend material. Specific composition was not provided, and inquiry was not made since this was not of consequence to the test. Specific-heat data was not available for this report.

Figures 70 through 74 show apparent thermal conductivity of epoxy-laminated fiberglass. The material is composed of glass-fabric 181 and U. S. Polymeric Epoxy, Novalac NMA. The resin content varies from 36 to 42 percent, with a specific gravity of 1.80 to 1.95. Figures 70, 71, and 72 are heat-flow measurements perpendicular to the laminations. Figures 73 and 74 are heat-flow measurements parallel to the laminations. Figures 70 and 74 exhibit discontinuities resulting from the delaminations prevalent in laminates of this type. Figures 75, 76, and 77 are curves of specific heat as a function of temperature for epoxy-laminated fiberglass. The sharp drop in Figures 75 and 76 indicates an epoxy-resin decomposition starting at approximately 600°F. Figure 77 is the same material precharred in an argon environment at 1000°F. In this figure, the curve is continuous to the prechar temperature since all decompositions were completed during precharring. The figure illustrates the specific heat of a charred epoxy-laminated fiberglass.

Figures 78 and 79 are the results of thermal conductivity measurements on phenolic-laminated fiberglass. The material is laminated of glass-cloth 181 and FM 5042 phenolic resin. The resin content varies from 36 to 42 percent, with a specific gravity of 1.80 to 1.95. These curves are not comparable because Figure 78 is a continuous cloth laminate while the material in Figure 79 contains chopped fiberglass. The tests were seriously limited because of the high tendency to delaminate, as shown in Figure 78.

### Teflon

Teflon\*, a product of Dupont, has received wide use in spacecraft. It has been studied at Avco as an ideal ablator for trying to understand material decomposition during reentry.<sup>1</sup> Teflon has been used for a variety of spacecraft components such as antenna windows, protective covers, etc. It is not considered to be a charring ablator, although, in some instances, where "char" is defined differently, some users indicate that Teflon does form a short-term char.

A limited amount of testing of Teflon was performed during this contract. The apparent thermal conductivity is shown in Figures 80 and 81 and the specific heat from drop calorimetry, in Figure 82.

At Avco, the material has been characterized in some detail, and Table X presents the more pertinent thermophysical characteristics. Figure 83 shows the apparent thermal conductivity of Armstrong Cork Material A2755, and Figure 84, the enthalpy-specific-heat determination. Figure 85 provides the change in apparent thermal conductivity when Armstrong A2755 is fabricated into a boost protective cover (Hyperlon front face and Teflon-fiberglass back-face laminate). The cover material tests were performed in an inert environment. Severe degradation of the A2755 occurred above 650°F, and, from the limited data on the cork, as compared to the composite, comments regarding the trend of the apparent thermal conductivity could not be conclusive since the basic material was tested to temperatures lower than the composite.

During the program, the laboratory measured, using the Parr Bomb calorimeter, the heat of combustion of A2755. The results of three measurements indicate the heat of combustion as 11,308 Btu/lb.

Relative to the discussion of other ablaters, NASA-MSC requested experimental measurements of Polyethylene DC325\*, and Marinite.\*\* The apparent thermal conductivity over a limited temperature range for Polyethylene is shown in Figure 86. Included on the Figure is the specific-heat variation over the 100° to 200°F temperature range.

DC325 in a hexagonal honeycomb was tested over the 100° to 400°F range. An attempt was made to obtain data to low temperatures, but the material has a higher expansion coefficient; samples machined at room temperature undergo such extensive contraction that interface errors did not permit valid low-temperature data. Figure 87 illustrates the apparent thermal conductivity of this material, and Figure 88 its specific heat. The multiple points on Figure 87 indicate re-runs and material stability over the test temperature range.

\*Product of Dow Corning

\*\*Product of Johns Manville.

Marinite, a product of the Johns Manville Co., is an asbestos-diathermaceous silica and binder provided in a variety of densities. The material tested had a density of 36 lbm/ft<sup>3</sup>. Figure 89 illustrates the normal apparent thermal conductivity of Marinite; the specific heat from room temperature to 500°F is also tabulated. Figure 90 illustrates the high-temperature variation of apparent thermal conductivity as a function of compressive load. The line on the figure shows the variation of apparent thermal conductivity with temperature under a 200 psia load. At 1000°F, the figure indicates a decrease of apparent thermal conductivity with decreasing load. Because of application requirements, these data have been included to illustrate the variation of apparent thermal conductivity as a function of compressive load. It was not anticipated that the temperature of the material would reach the elevated temperatures of the evaluation, but it is probable that, at the lower temperatures, as great a variation would not be expected.

Table XI presents, in addition to a summary of the tests as derived from an analysis of the raw data, the calculation of an arithmetic mean and standard deviation. Table XII are calculations of the first-order equations for each of the other ablators measured.

## 2.4 ADHESIVES AND SEALS

The following information identifies the materials included in this paragraph. Avco fabricated into test specimens, by lamination or casting processes, all of the materials listed.

### 2.4.1 Adhesives

#### 2.4.1.1 HT 424 Tape adhesive, American Cyanamid

There was no information as to composition available. It was reported that the material was a supported epoxy-phenolic adhesive film containing aluminum powder.

#### 2.4.1.2 Sylgard 182 Resin, Dow Corning

The only information provided was that the material is 100-percent resin of a specific gravity of 1.05.

#### 2.4.1.3 Epon Adhesive 931, Shell Chemical

The material is identified as a heat-resistant epoxy and adhesive consisting of two parts: (1) epoxy-novolac resin, similar to DEN 438, with an asbestos filler, and (2) a mixture of metaphenylene diamine and diethylene triamine.

#### 2. 4. 2 Seal

##### 2. 4. 2. 1 RTV 560 Resin, General Electric

The composition was not provided, but its specific gravity was given as 1. 4 to 1. 6.

The properties evaluated for the above materials are presented in Figures 91 to 111. (Refer to Table XIII.) Since most of these materials are of secondary importance, they have not been given specific discussion. The HT 424 materials were of particular interest since they were of concern during the aluminum-honeycomb panel evaluations. The variations to be noted regarding HT 424 were as follows:

- a) The significant apparent thermal conductivity curve contour difference of the four samples measured.
- b) The variations in the specific heat versus temperature curves as associated with previous discussions in the aluminum-honeycomb panel section. Table XIV presents a summary of the tests as derived from an analysis of the raw data. The Table illustrates the results of a calculation of the arithmetic mean and standard deviation. In Table XV are the results of calculations of the first-order equations for each seal and adhesive material measured during the program.

#### 2. 5 INSULATIONS

The type insulations measured during this program were inter-compartmental and cryogenic. The insulations were to be measured to decomposition temperatures at atmospheric pressure and some to a vacuum level of at least  $10^{-5}$  torr.

The materials selected for measurement, their characteristics, and their suppliers are as follows.

##### 2. 5. 1 Fibrous Insulation

TG-15000 is a product of the H. I. Thompson Company. The material was provided in semi-rigid board form (3 x 6 feet x various thicknesses). It consists of AA quartz fibers held together by a silicone resin.

##### 2. 5. 2 Multilayer Insulation

Two insulations of this type were defined.

###### 2. 5. 2. 1 NRC-2, National Research Corporation

NRC-2 is an aluminized mylar that is crinkled by a proprietary process.

## 2. 5. 2. 2 SI-62, Linde Corporation

The composition of the components was proprietary and not defined. The material consisted of alternate layers of very thin aluminum sheets and a thin matt-type insulation.

### 2. 5. 3 Insulation Test Results and Discussion

#### 2. 5. 3. 1 TG-15000

Figure 112 presents all the tests at atmospheric pressure on this insulation. The results show a large amount of scatter between the temperature 440° and 670°F. The scatter has been attributed to the decomposition of the silicone binder at atmospheric pressure.

Figure 113 presents the results of measurement of change in enthalpy as a function of temperature. Tabulated on the curve are the specific-heat values at the indicated temperatures.

Figures 114 through 118 are the test results of measurements in a vacuum. Considerable attention was directed to the "dips" in apparent thermal conductivity that appear on these figures. There was conclusive evidence that the dips were caused by the loss of the silicone binder from the sample. The evidence was complete when deposits of silicone were found on the apparatus components. It was also concluded that the evaporation of the binder occurs at lower temperatures with decreasing pressures, which would be expected as evidenced in the figures by the decrease in apparent conductivity at reduced pressures.

The maximum-use temperature was tentatively established as between 900° and 950°F. At the maximum temperature, the material loses most of its binder and takes on the characteristics of fiberglass matt-type materials.

#### 2. 5. 3. 2 NRC-2

NRC-2 is a laminated type insulation identified as crinkled aluminized mylar foil. The aluminizing of the mylar was understood to be a standard process. The crinkling process is proprietary, but, in general terms, it appeared to be a crepe finish. The nominal thickness of one sheet was specified as  $0.0005 \pm 0.0001$ -inch; the supplier, however, indicated the specification was being changed.

The insulation is commonly used in cryogenic applications. In spacecraft, it is applied so that the aluminized mylar foil has void separations between layers, with a layer density of about 50 layers/inch.

Because apparent thermal conductivity measurements on material layups in duplication of the application were not practical, an alternate procedure was

used for measurement. Measurements were performed with a guarded hot-plate apparatus in samples having a fixed number of layers; the thickness of the samples was regulated by spacers. One of the tests used 500 layers, varied from 1/4- to 1-inch thicknesses. Thus, the apparent thermal conductivity as a function of layer density (layers/inch) was obtained, providing data that could be useful for calculations in an expanded lay-up like those used in the vehicle. Other variations were also measured.

The results of atmospheric-pressure apparent thermal conductivity tests are shown in Figures 119 through 122. Specific-heat evaluations are shown in Figure 123. Reviewing the thermal conductivity data reveals the expected change in conductivity as a function of layer density varies from 500 to 2000 layers per inch, the conductivity at -200°F varies from 0.012 to 0.032 Btu/hr-ft-°F; at -100°F, the values vary from 0.013 to 0.038; and at 0°F, they vary from 0.021 to 0.064. The one unusual phenomenon was the delamination of the aluminum layer from the mylar substrate as a result of an excess-moisture environment. Inquiries into the phenomenon were limited. It was noted, however, that the occurrence was random. In some instances, it affected complete sheets; in other instances, only localized areas delaminated. The maximum exposure temperature was 190°F during this program, well below the specified maximum use temperature of 250°F.

#### 2. 5. 3. 3 SI-62

SI-62 presented several measurement problems because its components are fragile and because the apparent density depends upon the test sample compaction. Handling problems were reduced by measuring this material with a radial thermal conductivity apparatus.

The material layer density was 196 layers/inch, a layer consisting of foil and matt separator. The maximum test temperature attained during specific-heat measurements was 900°F. At the maximum temperature, the matt insulation appeared to melt and conglomerate, resulting in sample swelling.

Figures 124 and 125 are the results of apparent thermal conductivity measurements. Figure 126 represents the enthalpy results. Tests in Figure 124 were performed at atmospheric pressure; vacuum testing is illustrated in Figure 125.

Table XVI illustrates the results of an analysis of the raw data to determine an arithmetical mean and standard deviation. Some caution must be used when using Table XVII, which illustrates the first-order equation for the insulations measured. The equations were determined for the temperature interval specified in the test program and, in some instances noted on the Table. Table XVIII presents a complete tabulation of raw data for all thermal conductivity tests performed during the program.

## 2.6 TRANSIENT RESPONSE TESTS

Several tests were performed to determine the thermal response characteristics of aluminum-honeycomb panels (and the effects of using NASA thermal instrumentation specifications) for back up structures. Details of the test designs and procedures are summarized in Volume I. Figures 126 through 136 illustrate the results of these tests. The output variations that occurred during several tests, and which are illustrated in several figures, was attributed to manual operation of various controls and, in one instance (Test 15), to thermostatic control of the hot plate used. No significant anomalies were observed throughout the measurements. Specific comments on the results were not attempted since the purpose of these tests was primarily for agency instrumentation evaluation.

## 2.7 PRESSURE DROP TABULATION

A tabulation of data obtained during the performance of pressure drop measurements is presented in Table XIX and illustrated in Figures 138 through 141. These represent tests performed on the honeycomb ablator, in two directions relative to the cell walls and in two conditions: virgin and precharred. Column headings and symbols are as follows:

- a) A description of the material identification, cell orientation, and material state, e.g., virgin or 1380°F prechar; also, remarks related to test condition, e.g., initial run and rerun.
- b) Flow Meter Calibration Curve -- identifies the serial number associated with the flow meter used for each group of measurements. Flow meters used were Fischer and Porter all glass flowrator tubes; each tube was calibrated over its full scale range.
- c) Scale Readings -- readings taken directly off the flowrator being used.
- d)  $Q$  ( $\text{cm}^3/\text{min}$  or CFM) -- volume flow rate in  $\text{cm}^3/\text{min}$  or  $\text{ft}^3/\text{min}$  obtained from the calibration curves.
- e)  $P_L$  (Cm Hg) -- direct reading in centimeters taken at the meniscus of the fluid in the low leg of the mercury manometer connected upstream.
- f)  $P_H$  (Cm Hg) -- direct reading in centimeters taken at the meniscus of the fluid in the high leg of the mercury manometer connect downstream.
- g)  $P_L$  (Cm  $H_2O$ ) -- direct reading in centimeters taken at the meniscus of the fluid in the low leg of the water manometer connected upstream.

- h)  $P_H$  (Cm H<sub>2</sub>O) -- direct reading in centimeters taken at the meniscus of the fluid in the high leg of the water manometer connected downstream.
- i)  $w$  -- symbol denotes readings associated with the water manometer.
- j)  $Hg$  -- symbol denotes readings associated with the mercury manometer.
- k)  $P_H - P_L$  -- the difference between the manometer readings, or the water- or mercury-column height, representing a pressure drop.
- l) Gas Temp. -- temperature of the air taken down stream of the specimen.
- m)  $P_{BAR}$  -- ambient barometric reading in millimeters of mercury.
- n)  $L$  -- thickness of the specimen in inches.
- o)  $D$  -- diameter of the specimen in inches.
- p)  $M$  -- molecular weight of air.
- q)  $D_N$  Stream  $P_L$  (Cm H<sub>2</sub>O) -- direct reading in centimeters taken at the meniscus of the fluid in the low leg of the water manometer connected downstream.
- r) Up Stream  $P_H$  (Cm H<sub>2</sub>O) -- direct reading in centimeters taken at the meniscus of the fluid in the high leg of the water manometer open to atmosphere.
- s) Pressure down stream (lbf/in.<sup>2</sup> abs) -- calculated absolute pressure in pounds per square inch in the downstream region, based on barometric pressure and measured downstream pressure differential.
- t) Sample  $\Delta P$  -- pressure drop across the specimen.
- u) Upstream Pressure (lbf/in.<sup>2</sup> abs) -- calculated absolute pressure in pounds per square inch in the upstream region, based on downstream absolute pressure and specimen pressure drop.

v)  $\rho$  air -- density of dry air in lb/ft<sup>3</sup>.

w)  $\mu$  air -- viscosity of air in centipoises.

Several plots of the pressure drop as a function of air flow rate for all tests performed are illustrated in Figures 138 through 141. Reference 2 was used to correlate, by a two-term quadratic, the pressure drop resulting from a mass flow through a complex porous medium: the two term

$$\frac{P_1^2 - P_2^2}{R T L \dot{m}^2} = 2\alpha \frac{\mu}{m} + 2\beta,$$

where

$P_1$  and  $P_2$  = upstream and downstream pressures

R = gas constant

T = temperature

L = specimen thickness

$\dot{m}$  = gas mass flow

$\mu$  = gas viscosity

Preliminary calculations yielded  $\alpha$  &  $\beta$  terms, describing the inertial and viscous resistance coefficients of  $463.0 \times 10^8 \text{ ft}^{-2}$  and  $0.00615 \times 10^8 \text{ ft}^{-1}$ , respectively, for virgin material parallel to the cell walls.

#### REFERENCES

1. Wentink T. Jr., Avco Research Laboratory Research Report 45 (July 1959).
2. Green L. Jr., and P. Duwez, "Fluid Flow Through Porous Metals," J. Applied Mech., (Mar 51), pp 39-45.

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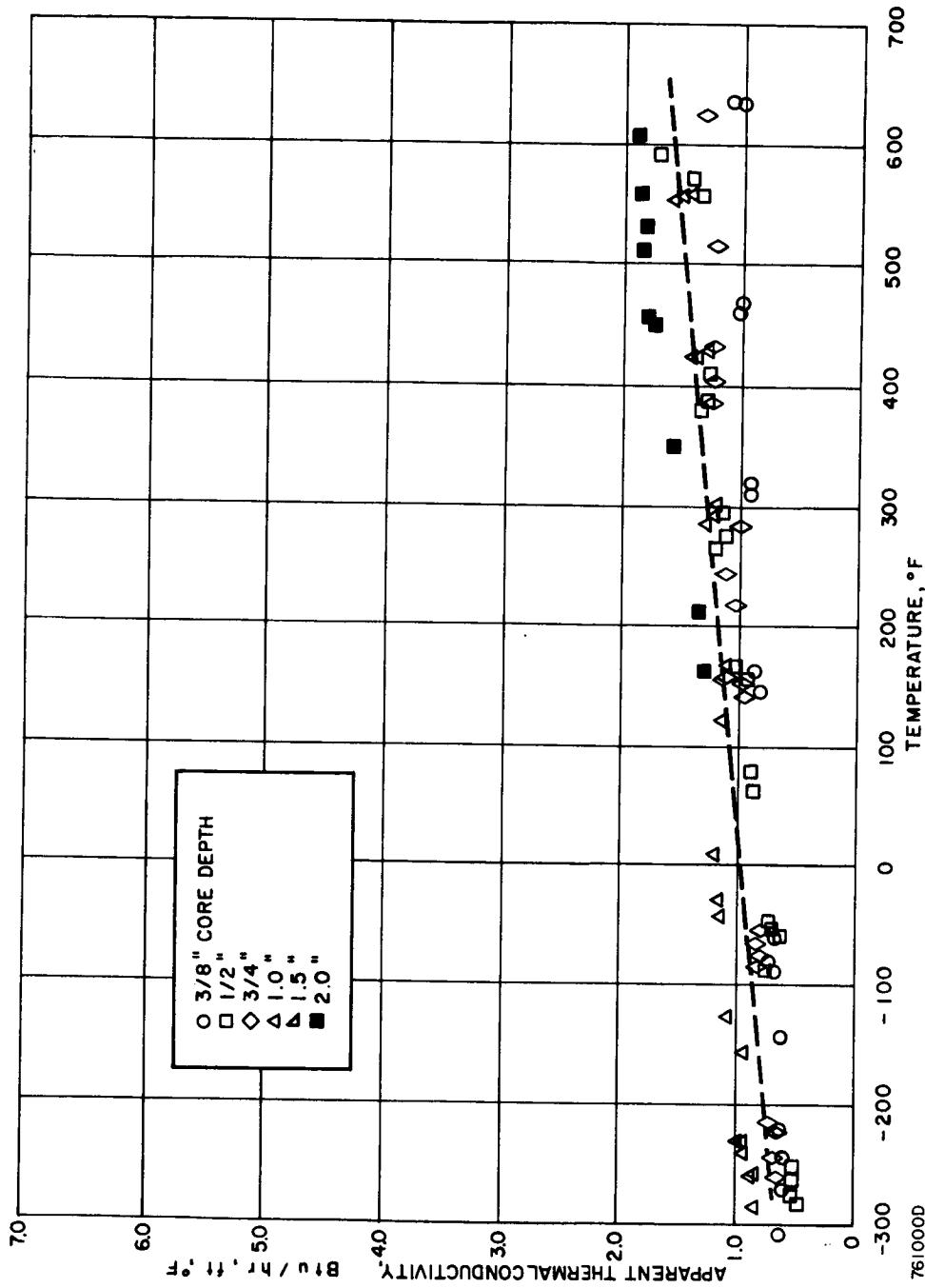


Figure 1 APPARENT THERMAL CONDUCTIVITY OF ALUMINUM HONEYCOMB PANELS OF  
VARIOUS CORE DEPTHS, 1/4-5052-H39-0.001P, 2.3 lbm/ft<sup>3</sup>

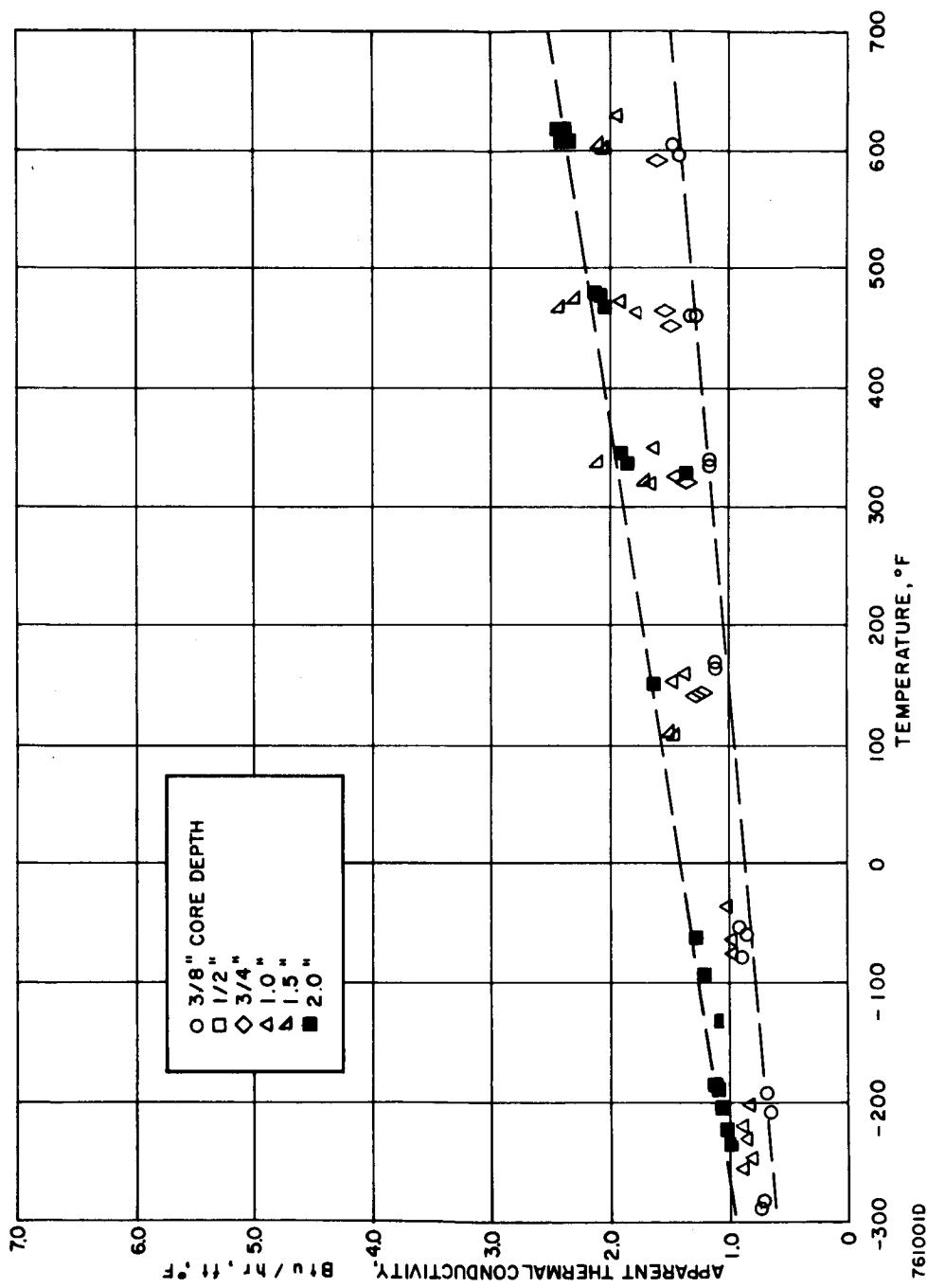


Figure 2 APPARENT THERMAL CONDUCTIVITY OF ALUMINUM HONEYCOMB PANELS OF VARIOUS CORE DEPTHS, 3/16-5052-H39-0.001P, 3.1 lbm/ft<sup>3</sup>

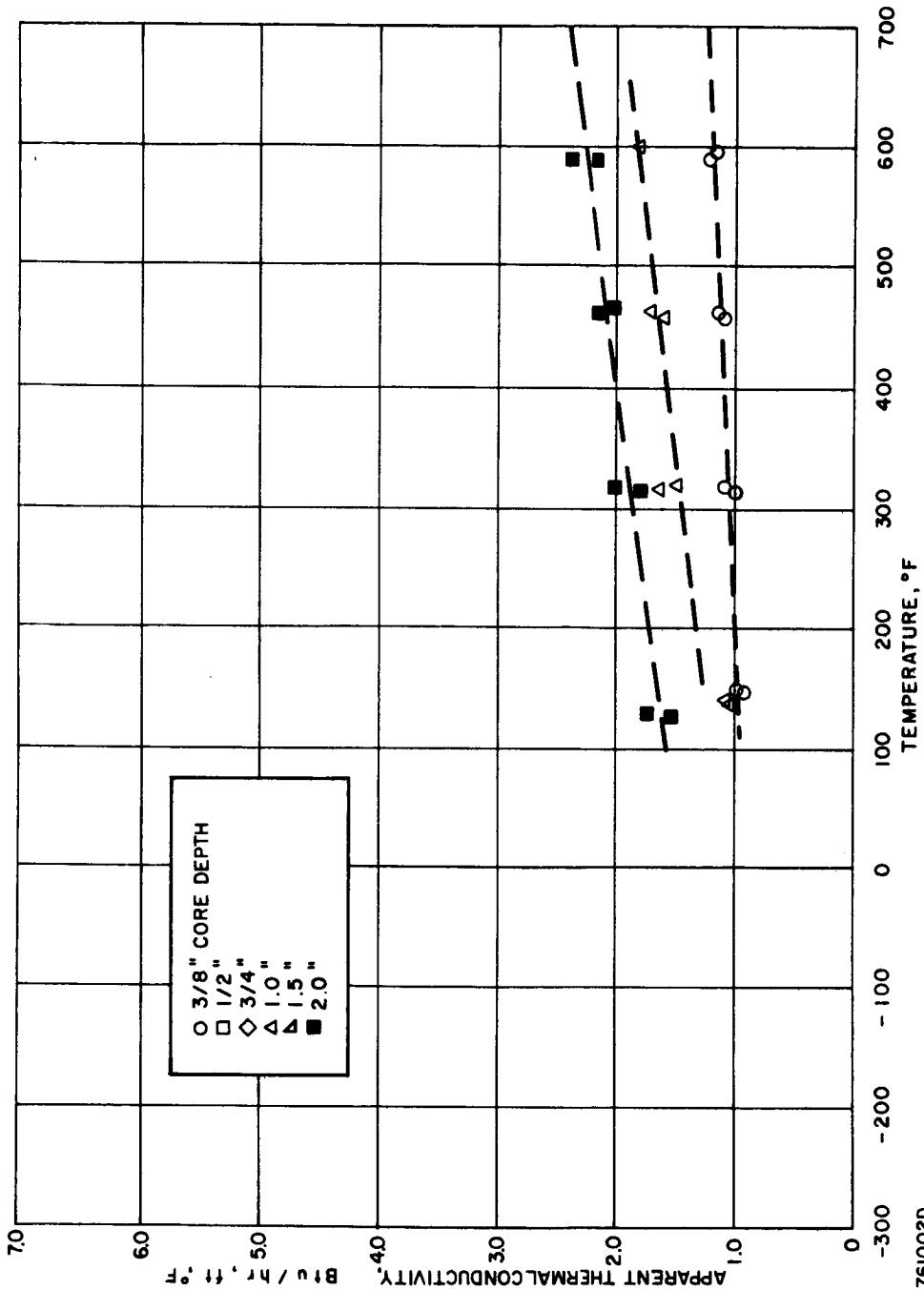


Figure 3 APPARENT THERMAL CONDUCTIVITY OF ALUMINUM HONEYCOMB PANELS OF VARIOUS CORE DEPTHS, 14-5052-H39-0.0015P, 3.4 lbm/ft<sup>3</sup>

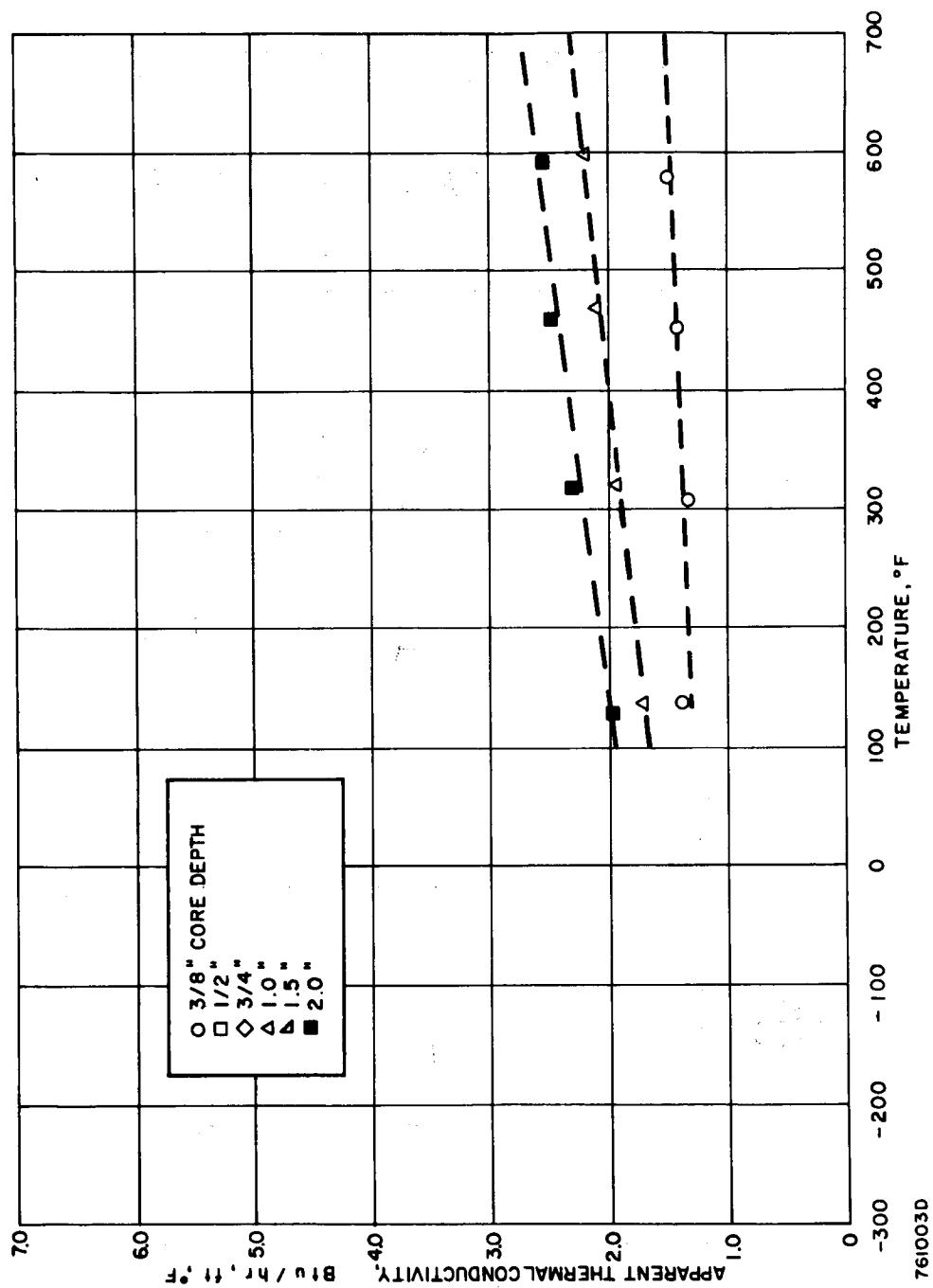


Figure 4 APPARENT THERMAL CONDUCTIVITY OF ALUMINUM HONEYCOMB PANELS OF  
VARIOUS CORE DEPTHS, 3/16-5052-H39.0.0015P, 4.4 lbm/ft<sup>3</sup>

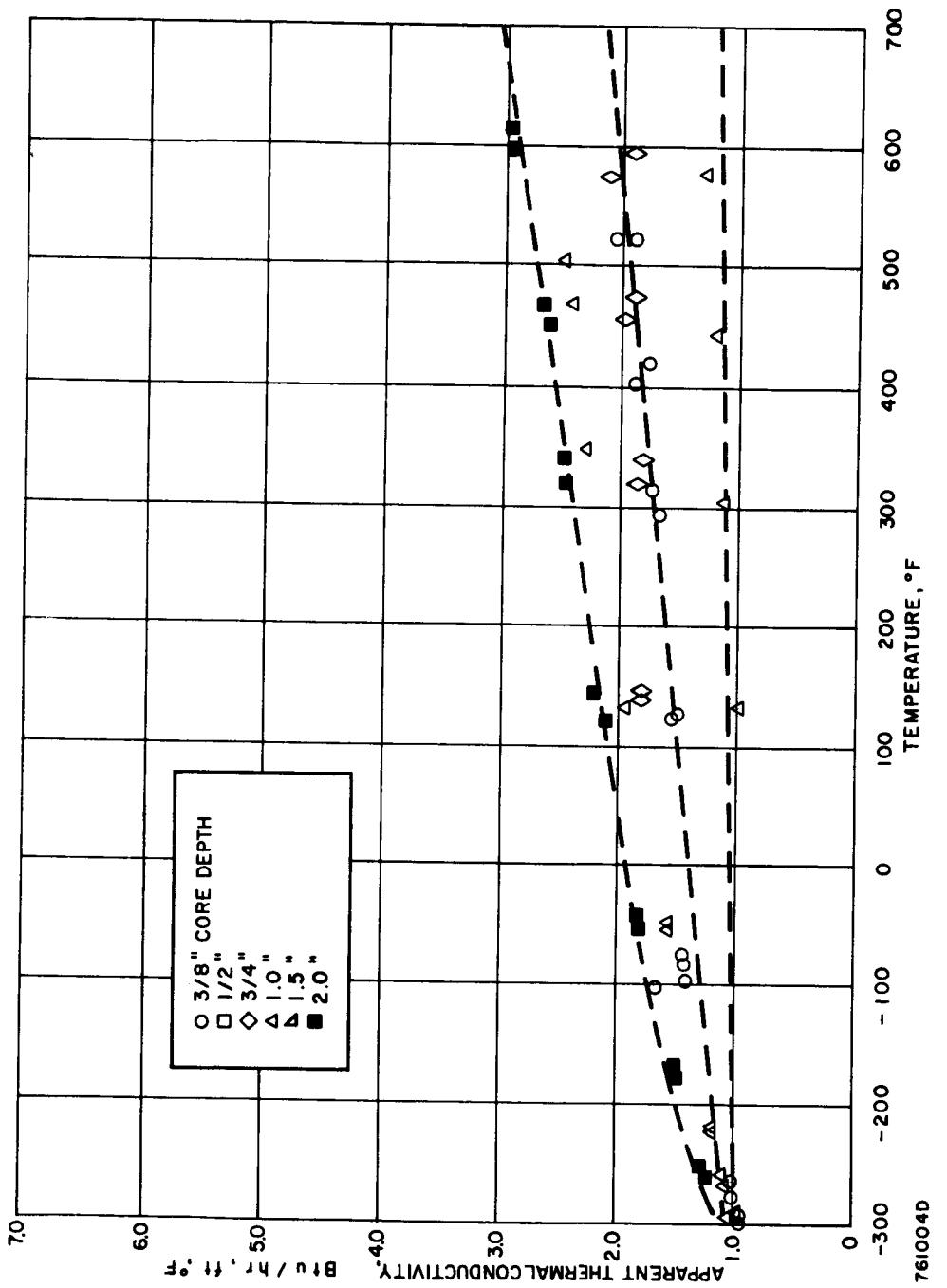


Figure 5 APPARENT THERMAL CONDUCTIVITY OF ALUMINUM HONEYCOMB PANELS OF  
VARIOUS CORE DEPTHS, 1/8-5052-H39-0.001P, 4.5 lbm/ft<sup>3</sup>

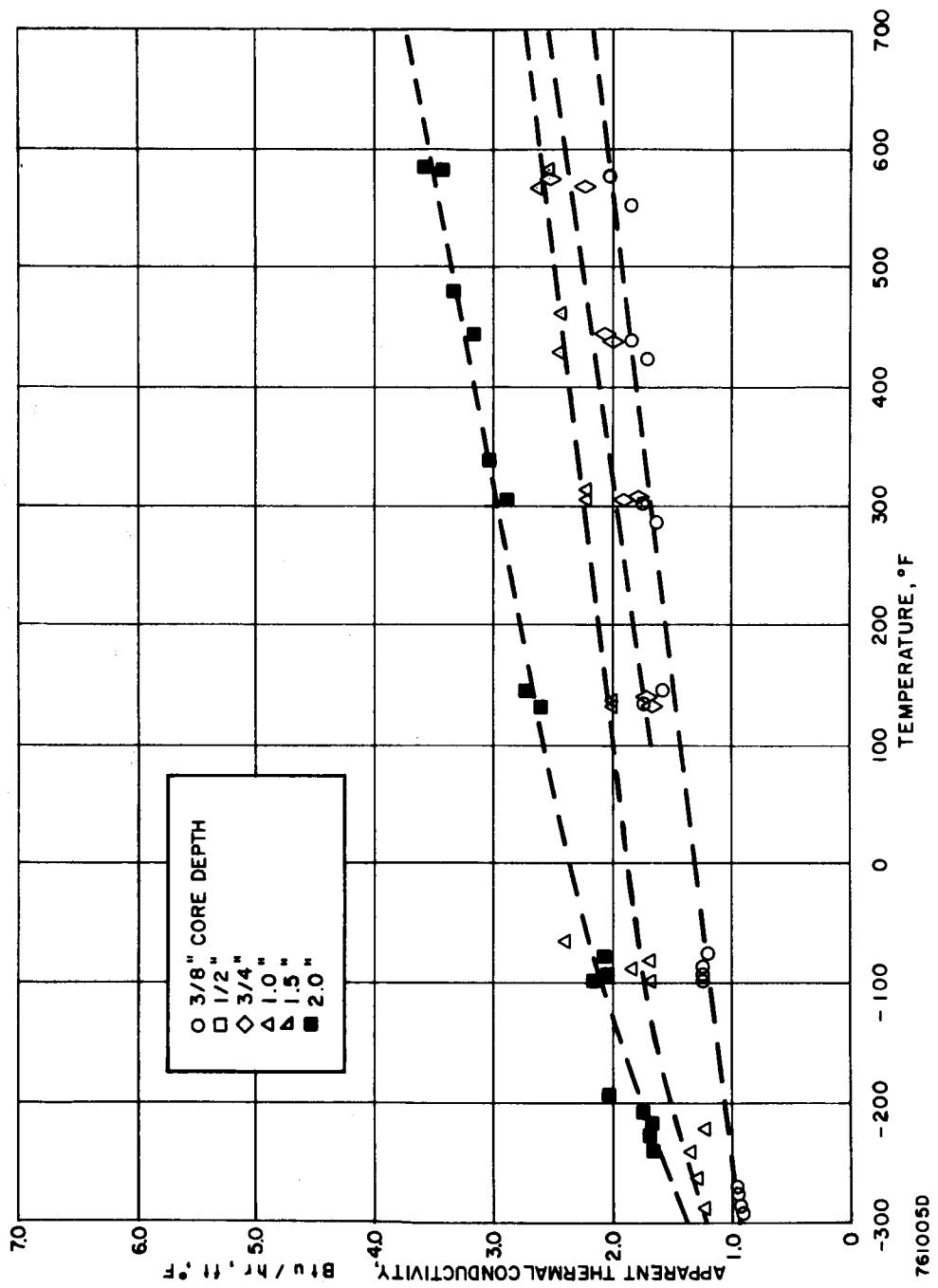


Figure 6 APPARENT THERMAL CONDUCTIVITY OF ALUMINUM HONEYCOMB PANELS OF  
VARIOUS CORE DEPTHS, 1/4-5052-H39-0.003P, 6.0 lbm/ft<sup>3</sup>

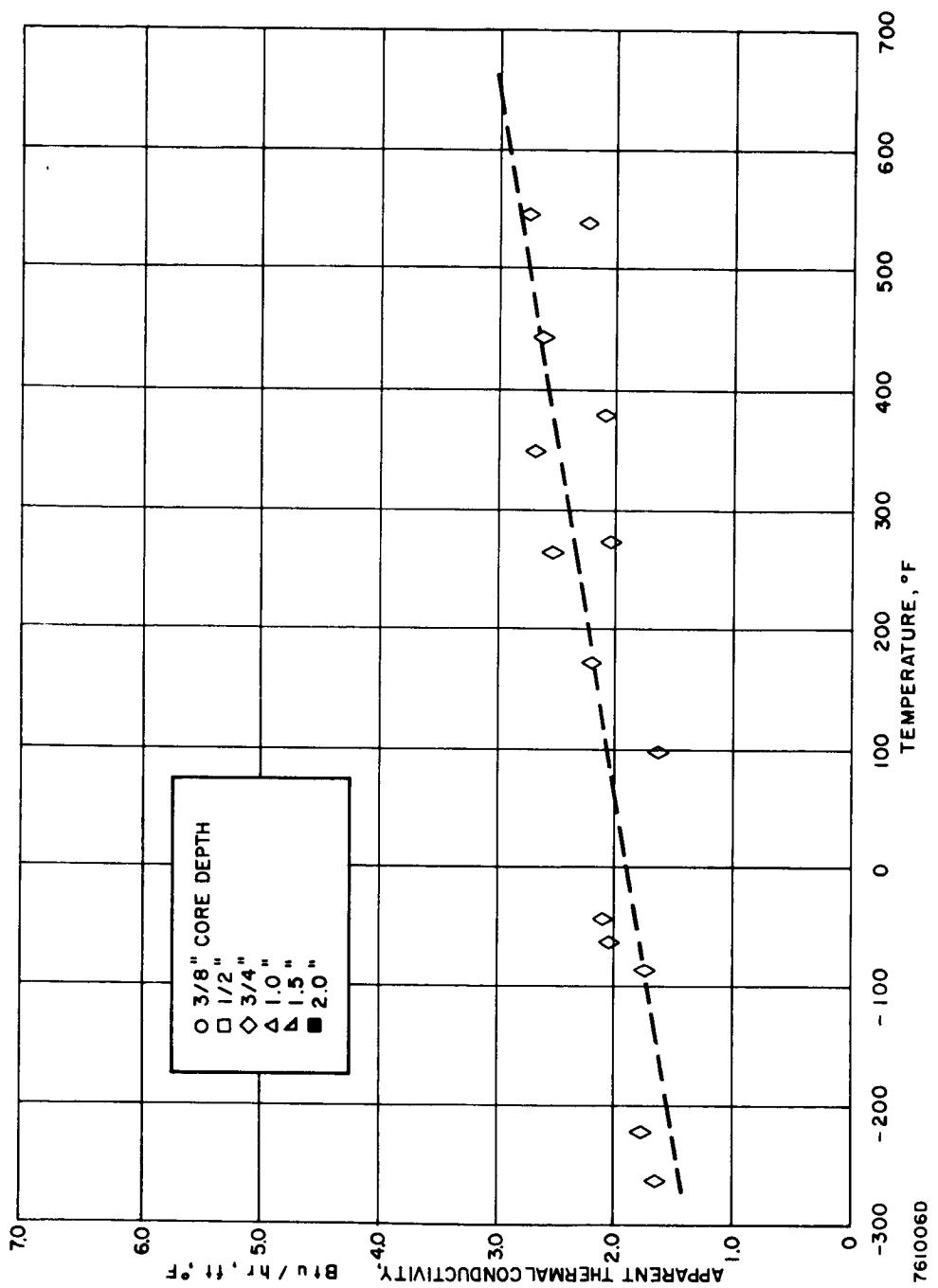


Figure 7 APPARENT THERMAL CONDUCTIVITY OF ALUMINUM HONEYCOMB PANELS OF  
VARIOUS CORE DEPTHS, 1-8-5052-H39-0.0015P, 6.1 lbm/ft<sup>3</sup>

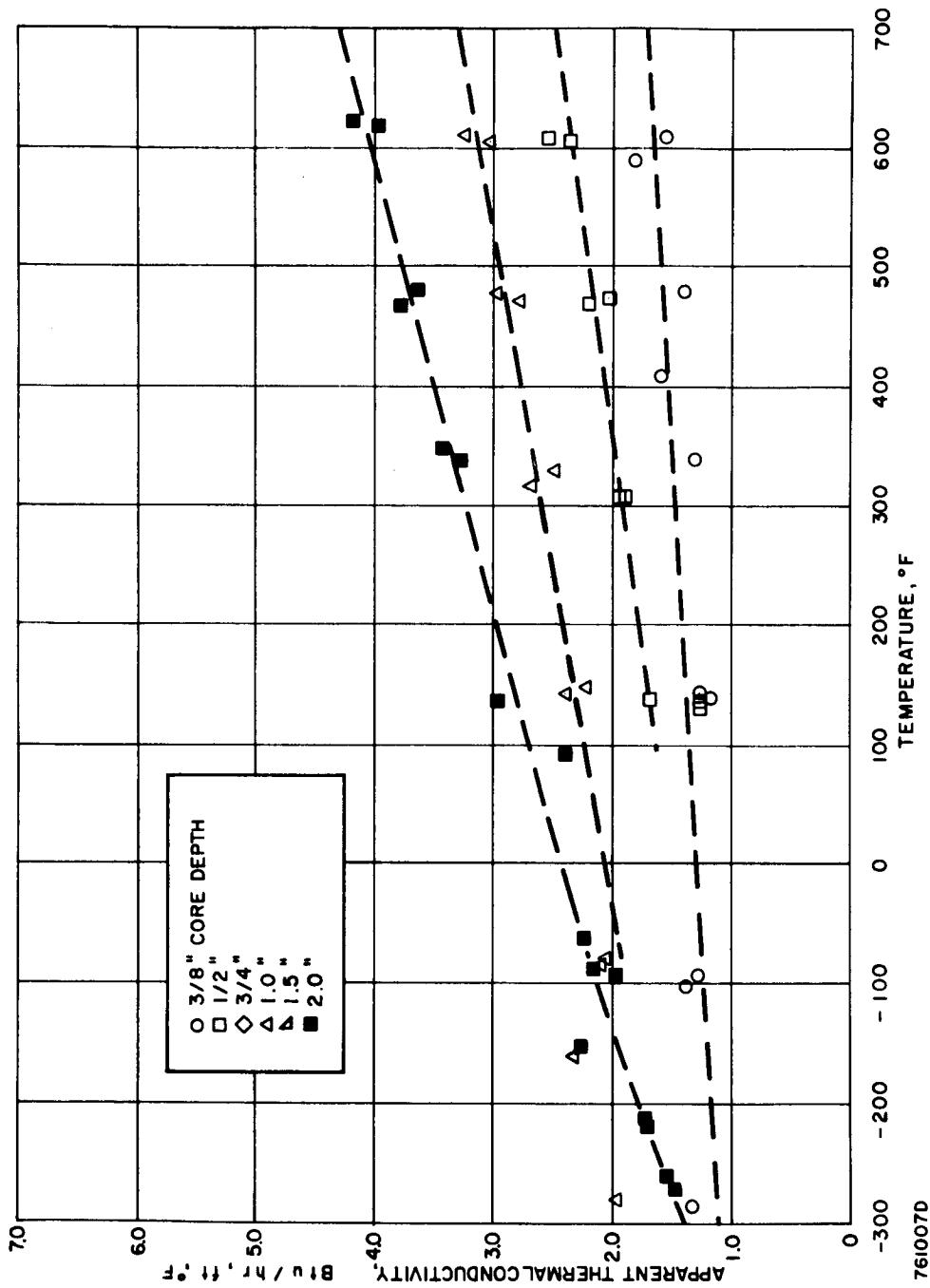


Figure 8 APPARENT THERMAL CONDUCTIVITY OF ALUMINUM HONEYCOMB PANELS OF  
VARIOUS CORE DEPTHS, 3/16-5032-H39-0-003P, 8.1 lbm/ft<sup>3</sup>

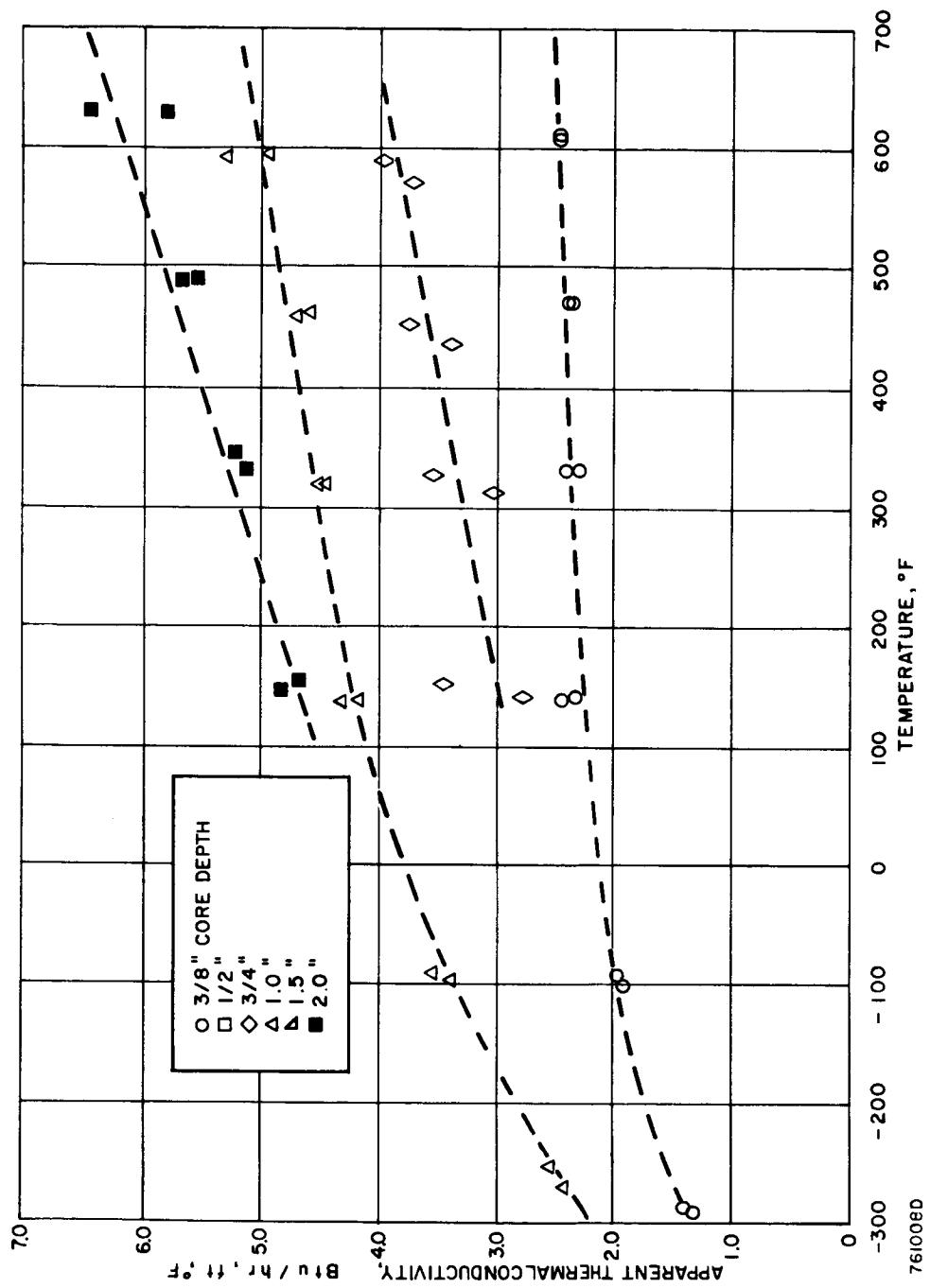


Figure 9 APPARENT THERMAL CONDUCTIVITY OF ALUMINUM HONEYCOMB PANELS OF  
VARIOUS CORE DEPTHS, 1/8-5052-H39-0.003P, 12.0 lbm/ft<sup>3</sup>

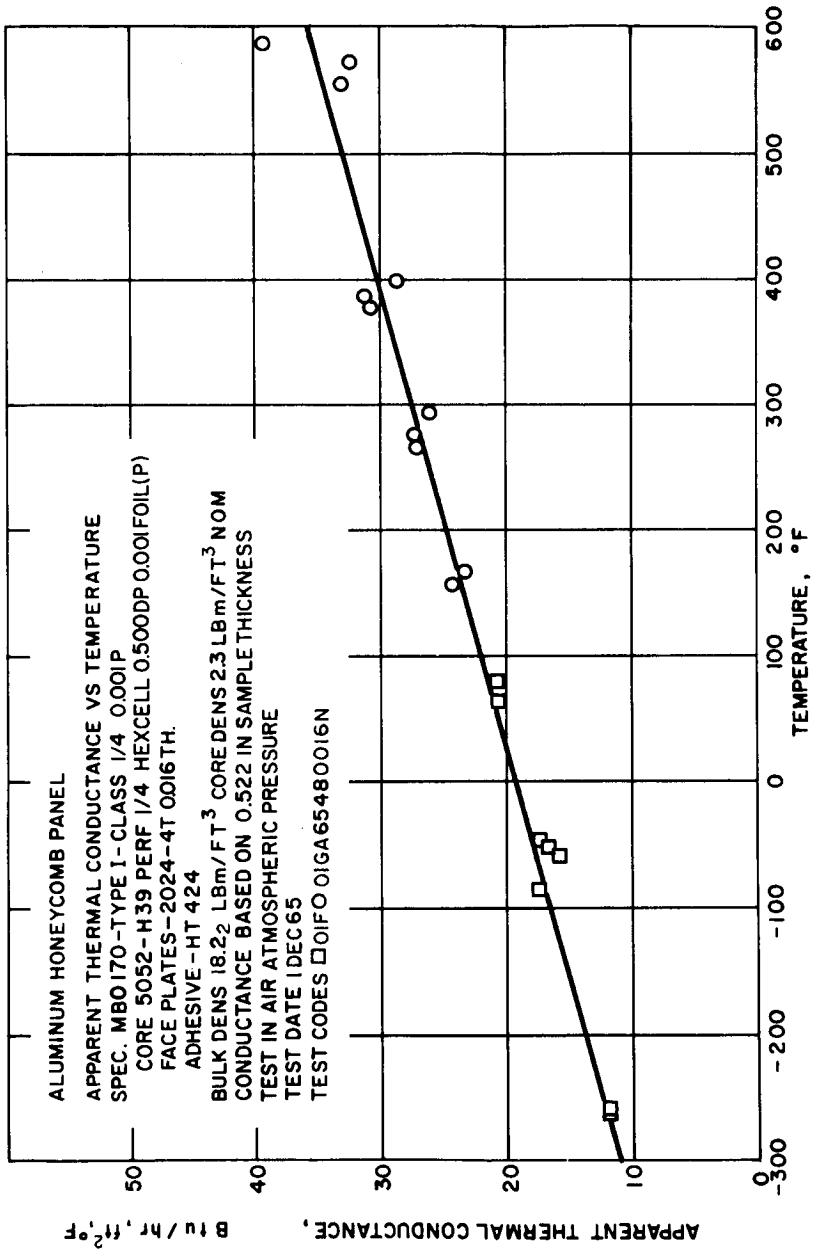


Figure 10 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM HONEYCOMB PANELS, 1/4-5052-H39-0.001P, 1/2-INCH DEEP

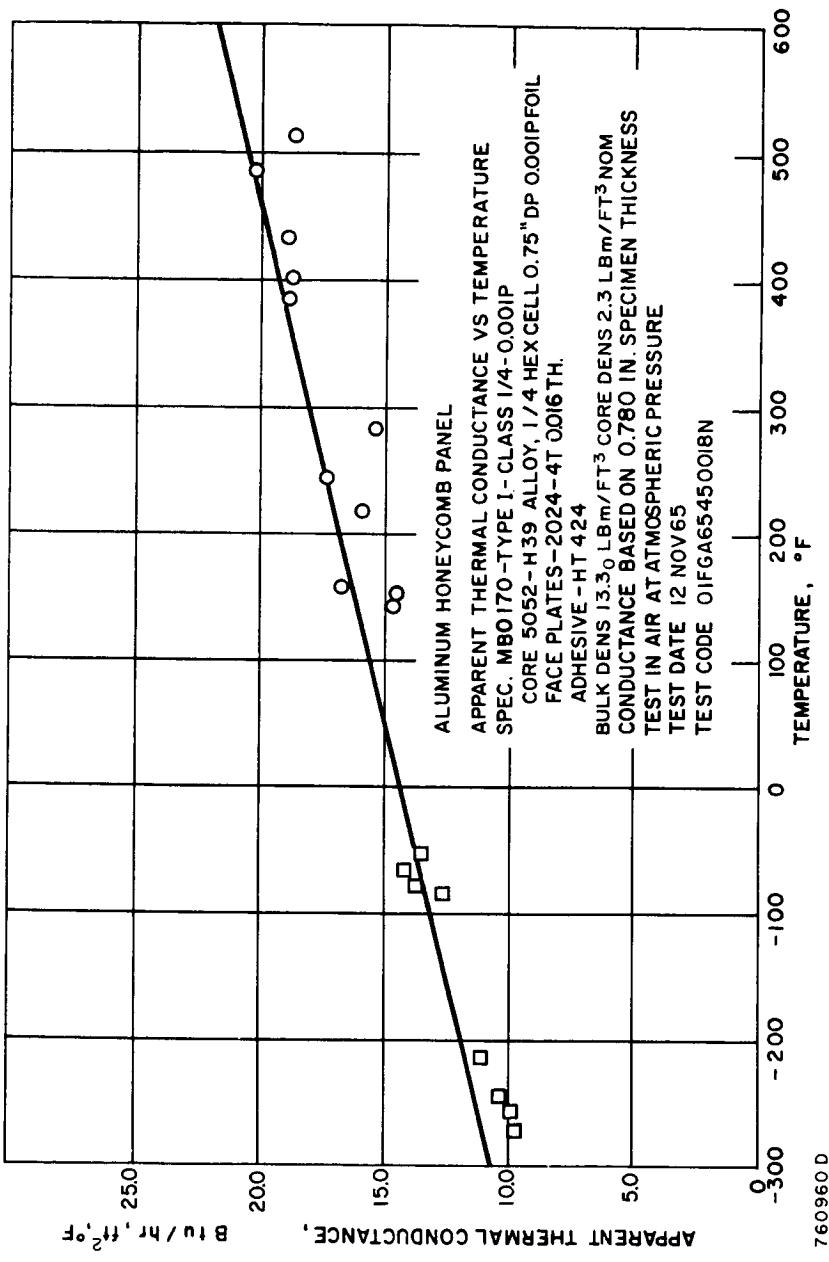


Figure 11 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
HONEYCOMB PANELS, 1/4-5052-H39 0.001P, 3/4INCH DEEP

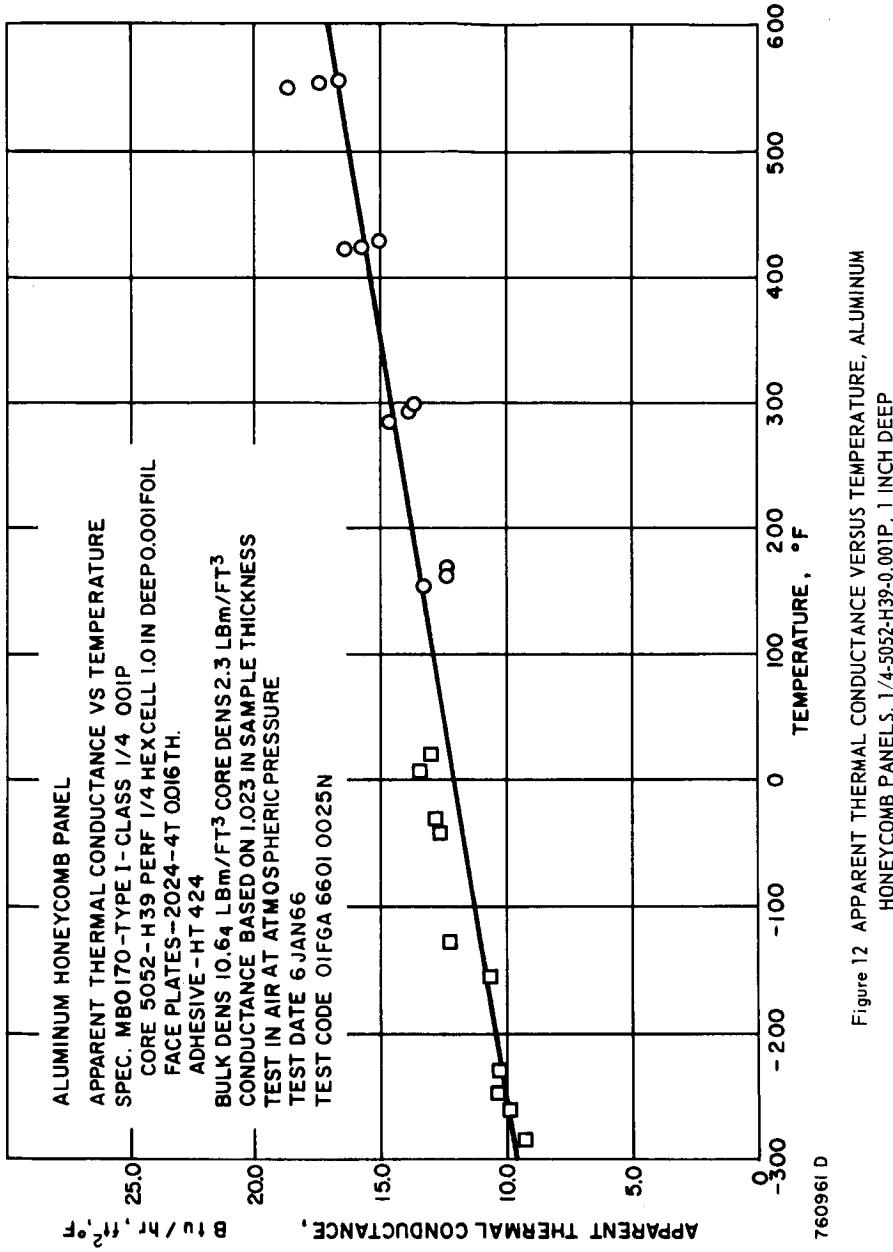


Figure 12 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
HONEYCOMB PANELS, 1/4-5052-H39-0.001P, 1 INCH DEEP

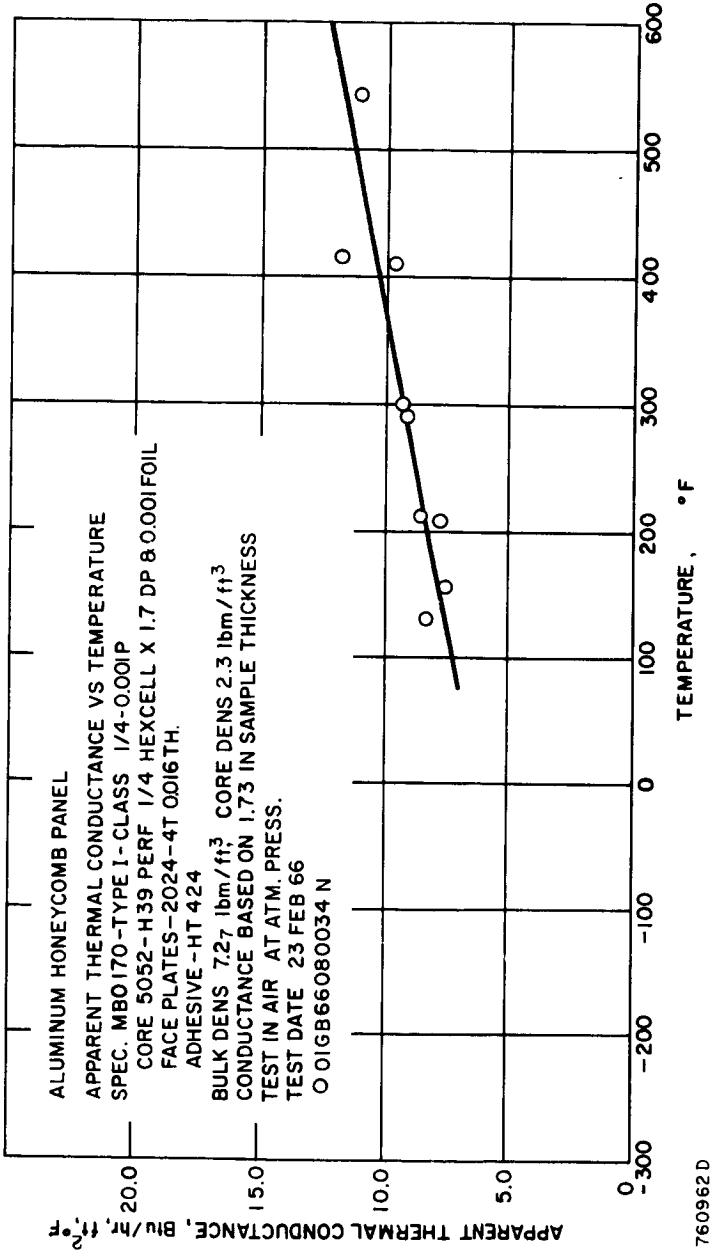


Figure 13 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
 HONEYCOMB PANELS, 1/4-5052-H39-0.001P, 1.7 INCHES DEEP

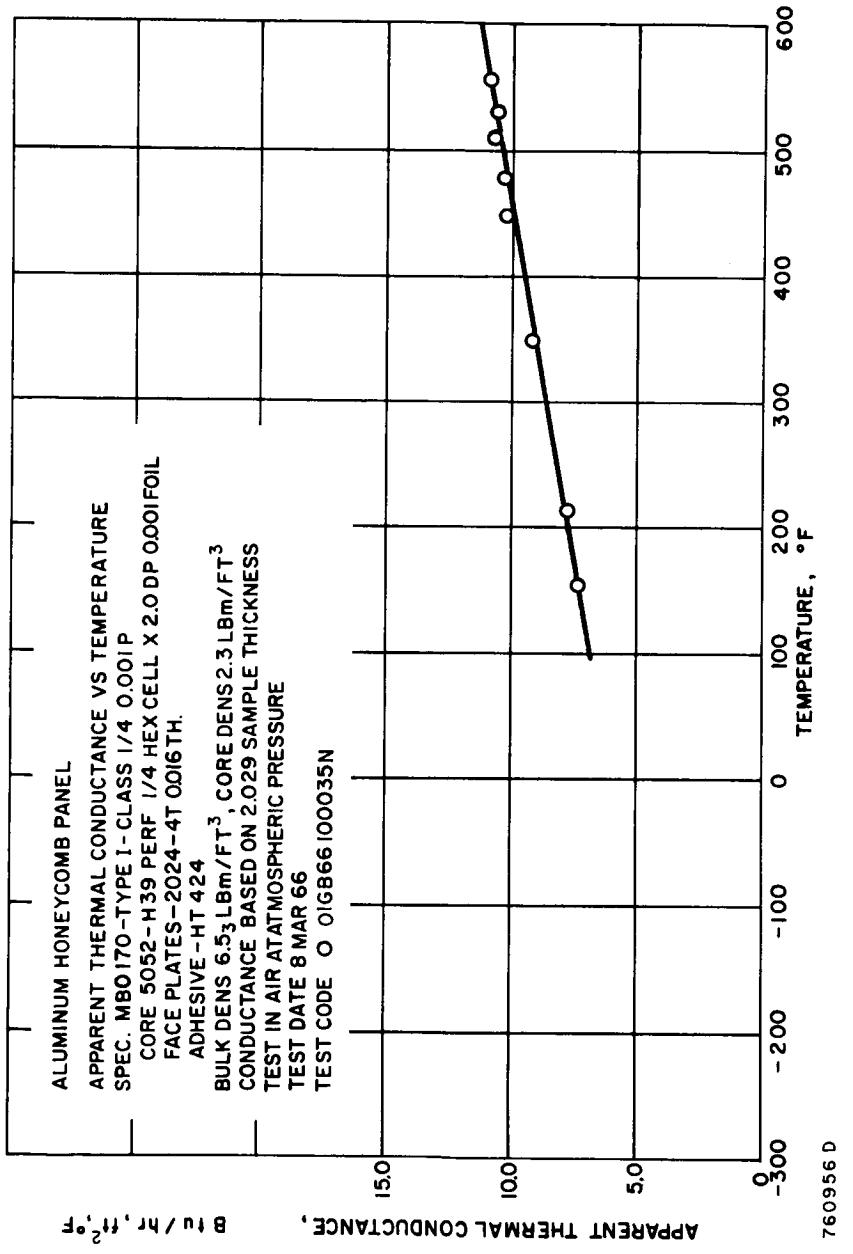


Figure 14 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
HONEYCOMB PANELS, 1/4-5052-H39-0.001P, 2 INCHES DEEP

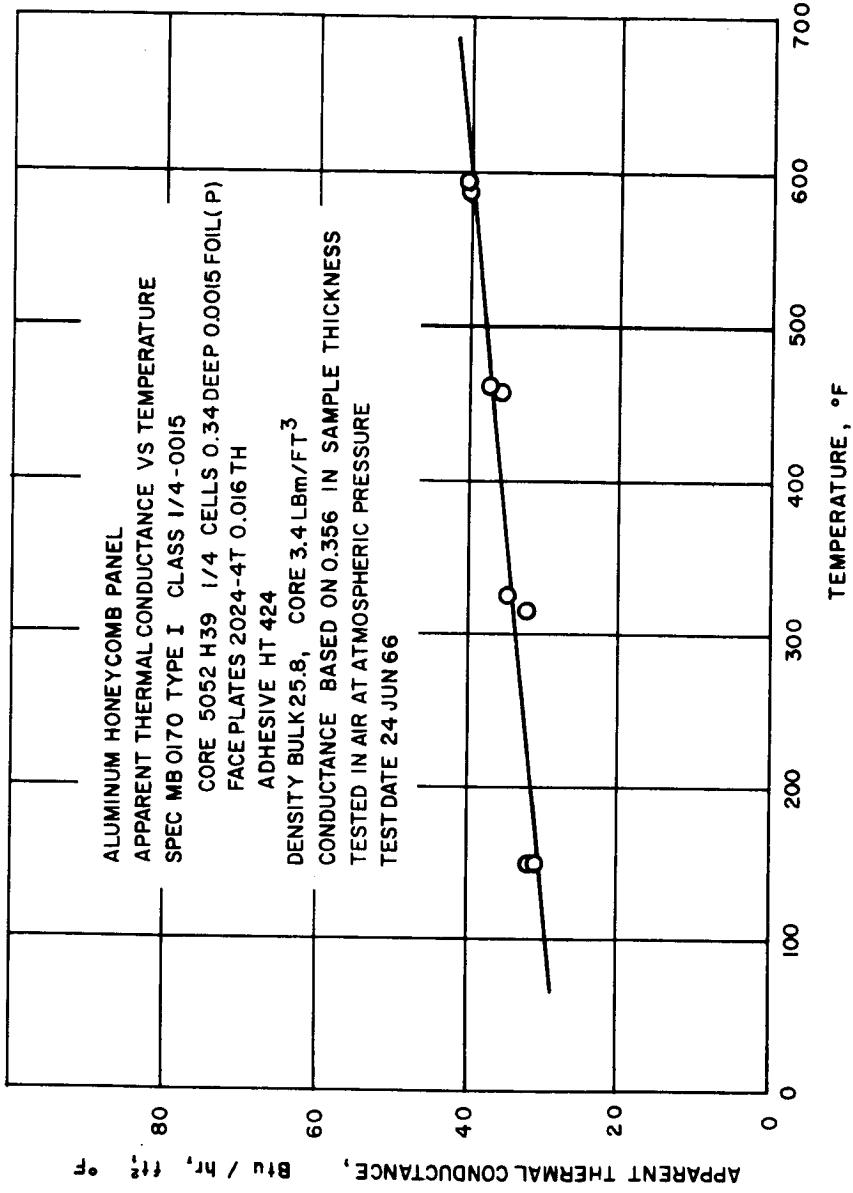


Figure 15 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
HONEYCOMB PANELS, 1/4-5052-H39-0.0015P, 3/8-INCH DEEP

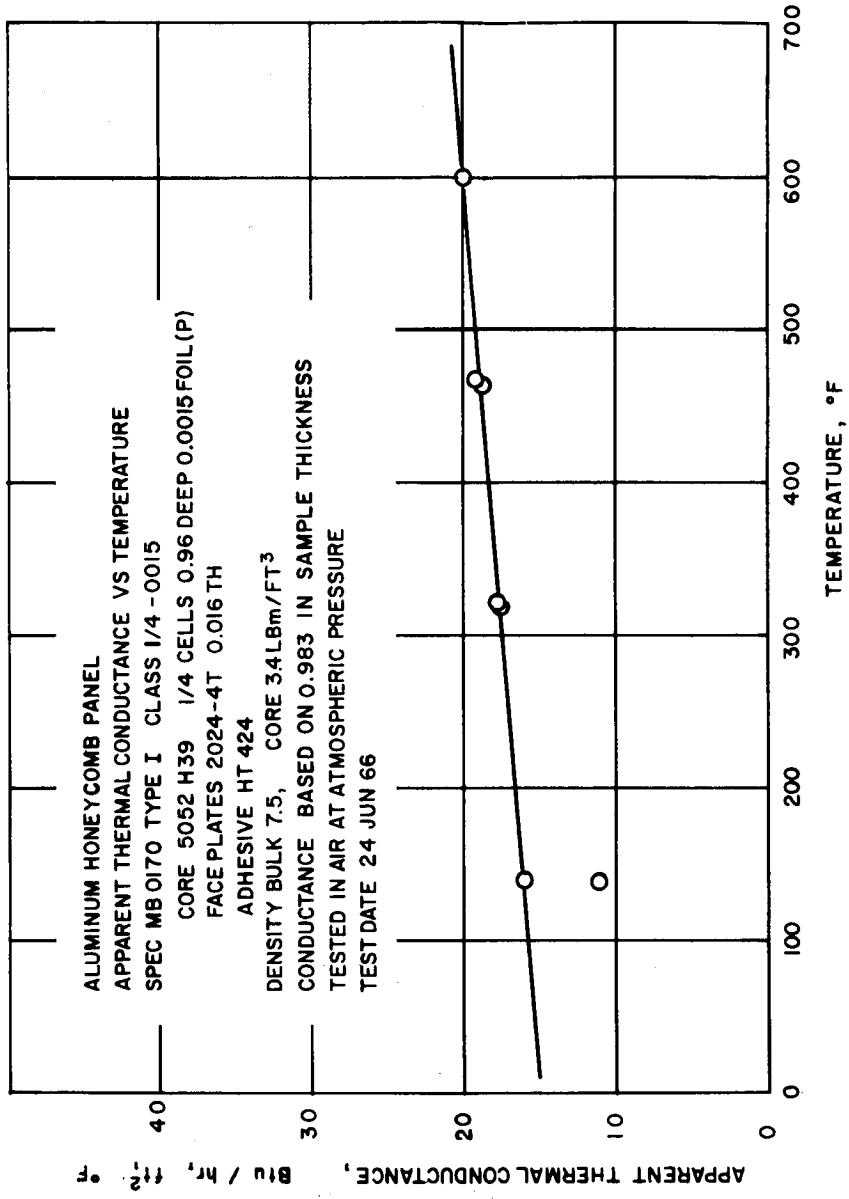


Figure 16 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
HONEYCOMB PANELS, 1/4-5052-H39-0.0015P, 1 INCH DEEP

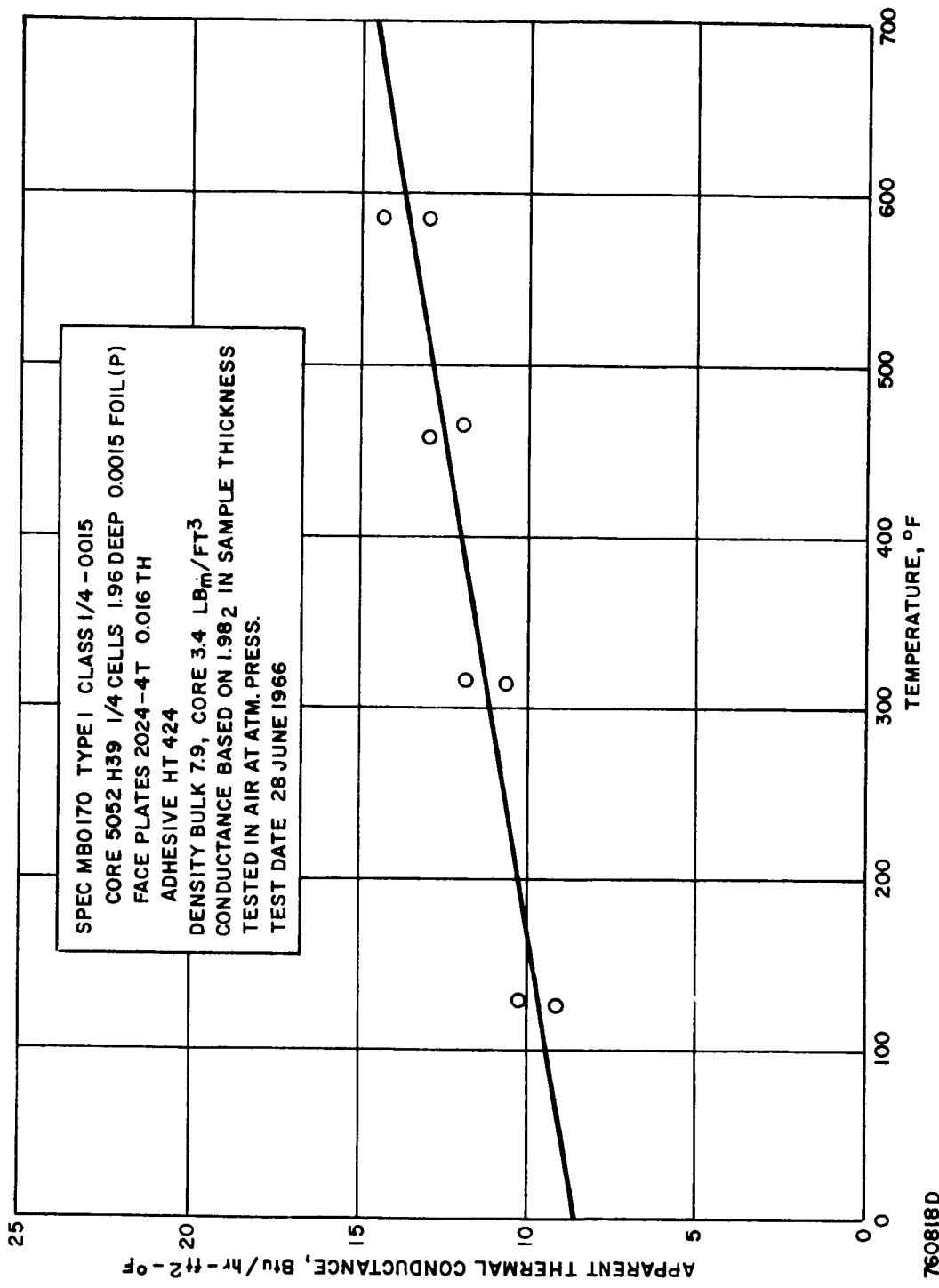


Figure 17 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
 HONEYCOMB PANELS, 1/4-5052-H39-0.0015P, 2 INCHES DEEP

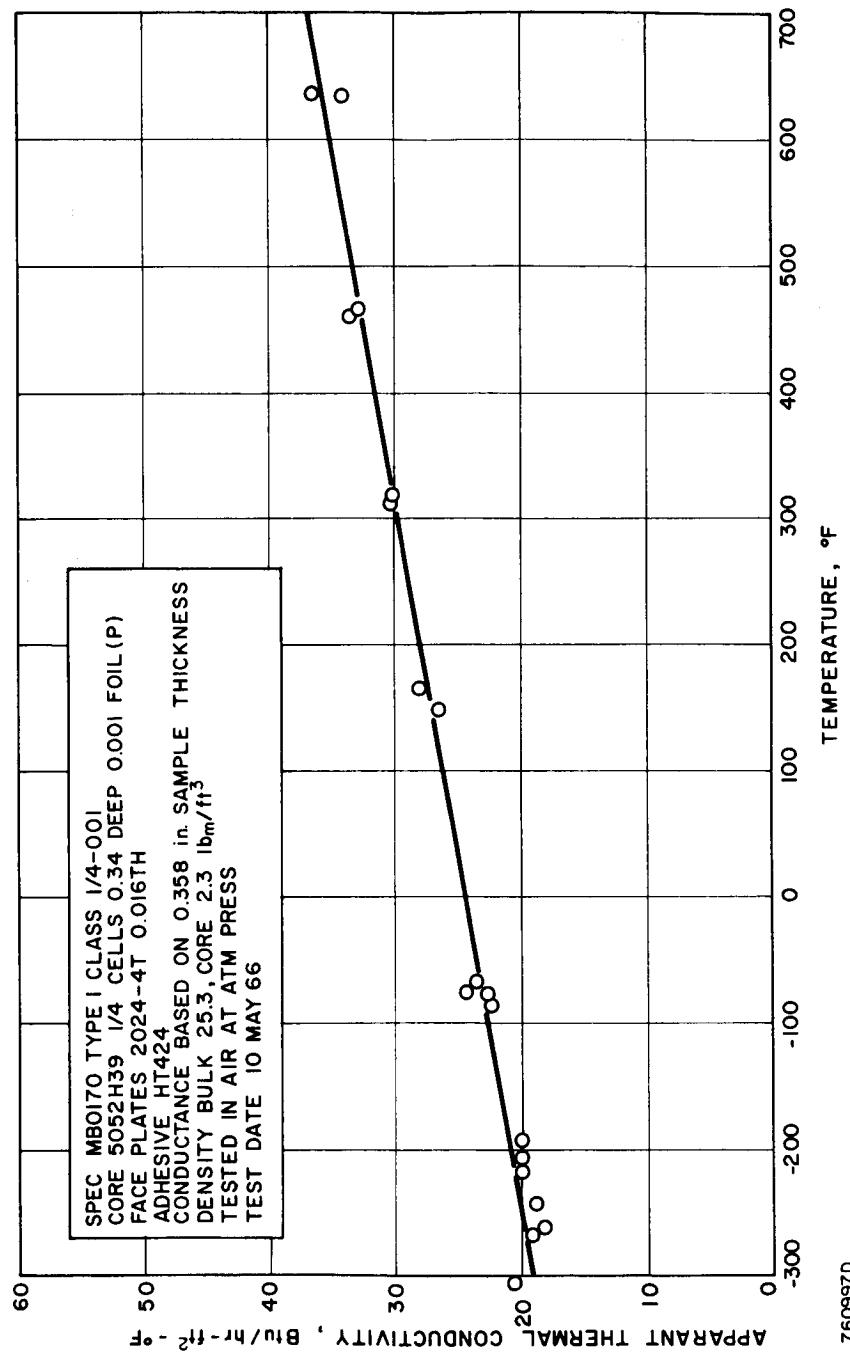


Figure 18 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
HONEYCOMB PANELS, 1/4-5052-H39-0.001P, 3/8-INCH DEEP

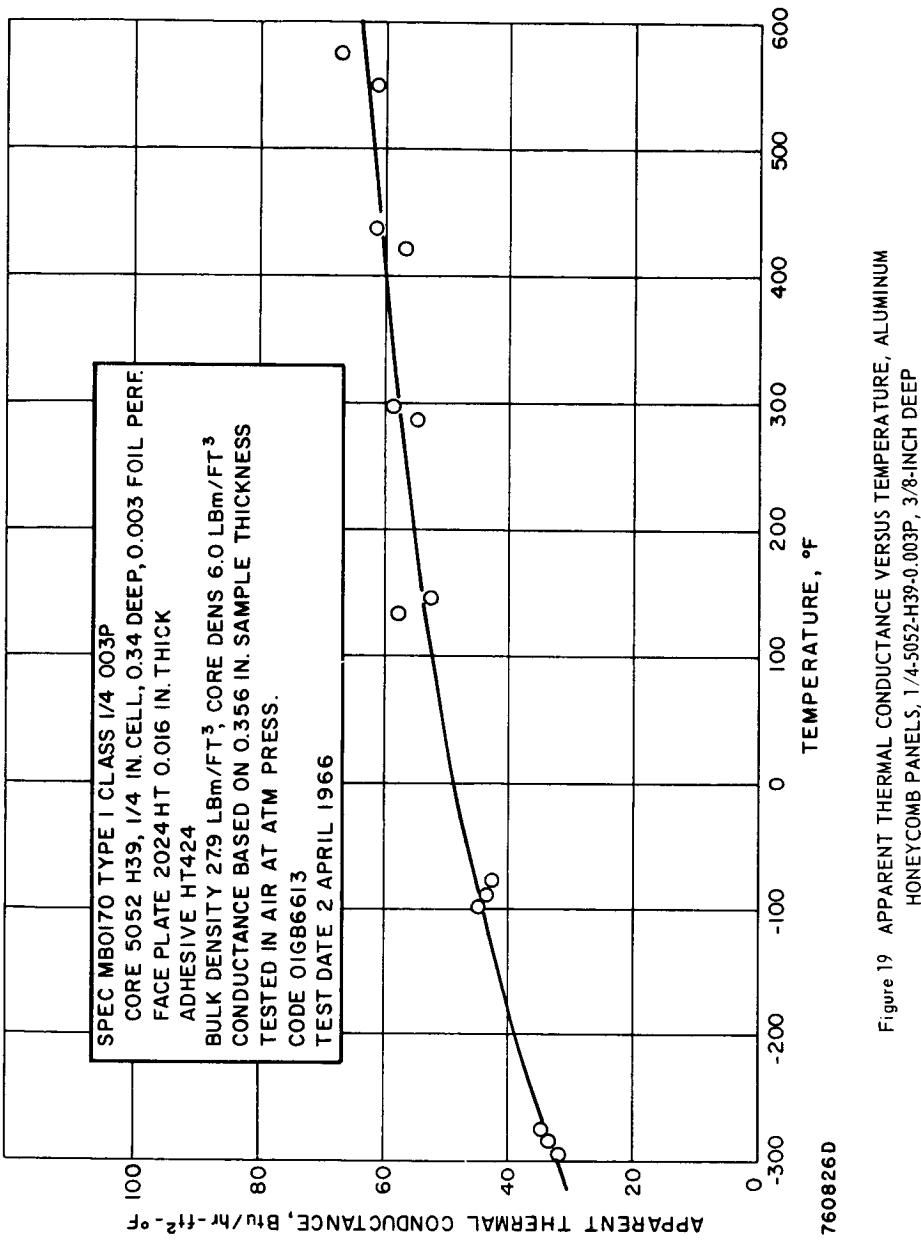


Figure 19 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
HONEYCOMB PANELS, 1/4-5052-H39-0.003P, 3-8-INCH DEEP

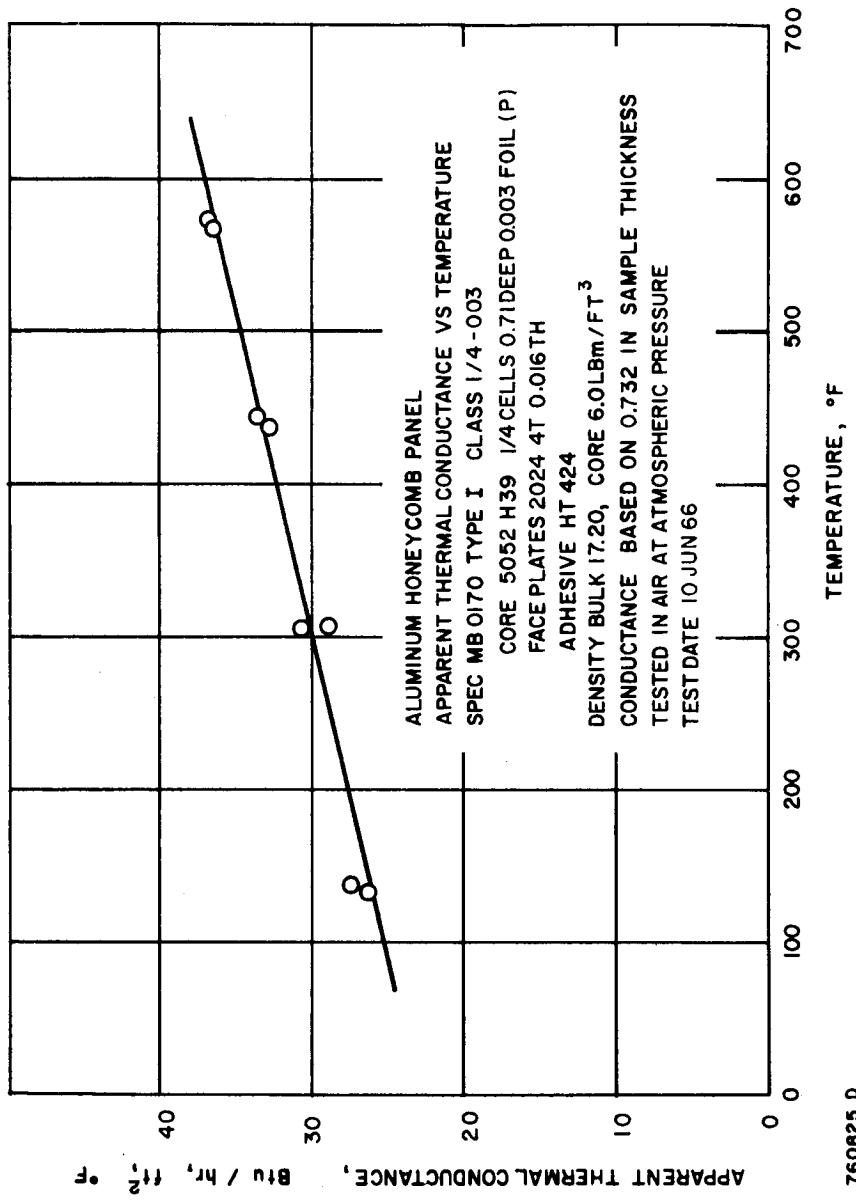


Figure 20 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM HONEYCOMB PANELS, 1/4-5052-H39-0.003P, 3/4-INCH DEEP

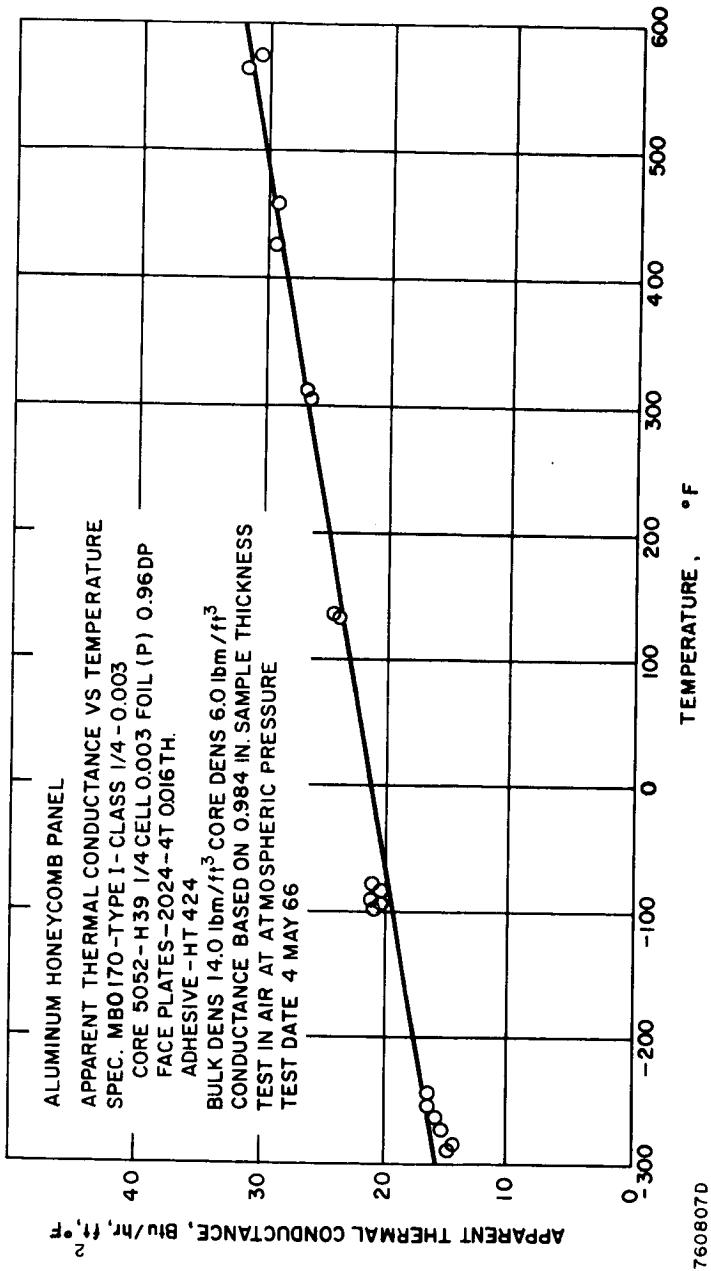


Figure 21 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
HONEYCOMB PANELS, 1/4-5052-H39 0.003P, 1 INCH DEEP

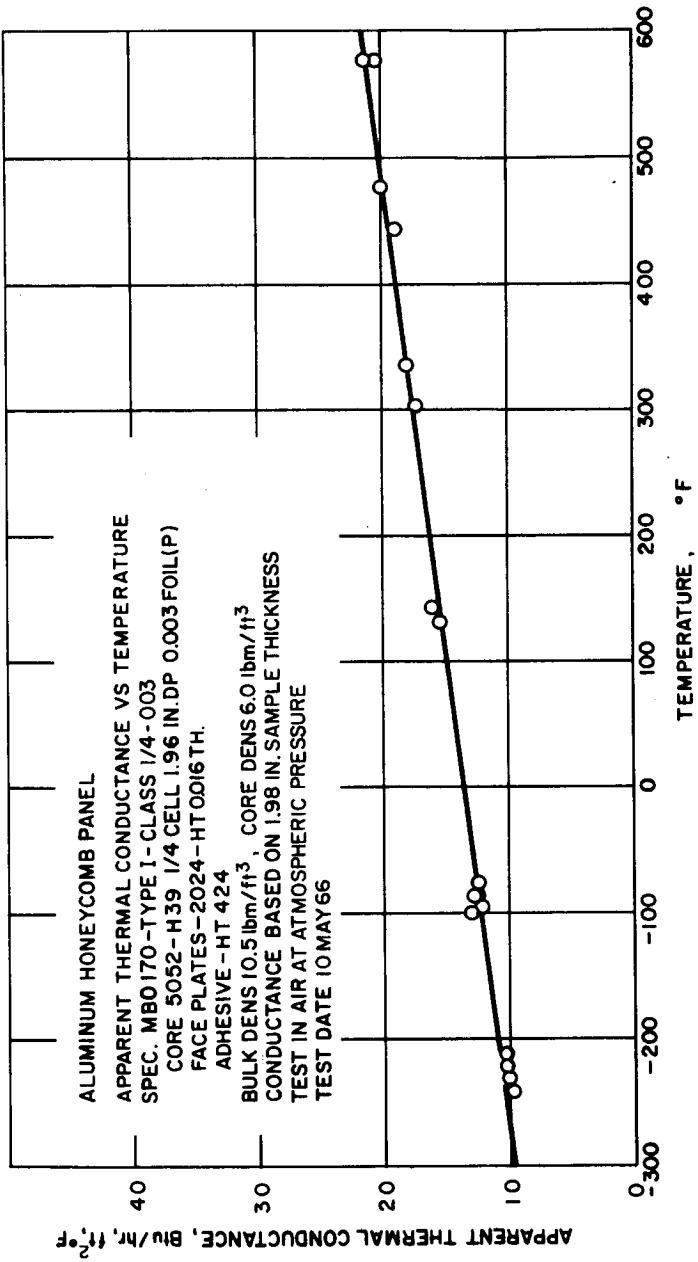


Figure 22 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
HONEYCOMB PANELS, 1/4-5052-H39-0.03P, 2 INCHES DEEP

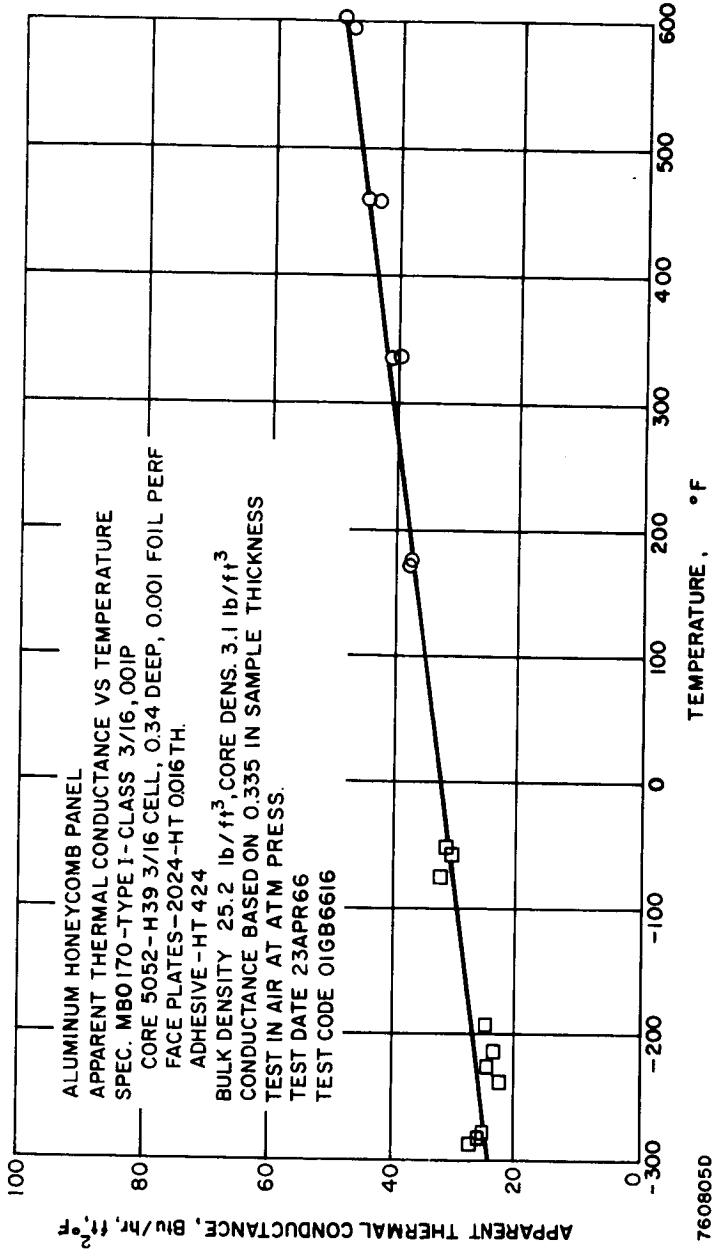


Figure 23 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
HONEYCOMB PANELS, 3/16-5052-H39-0.001P, 3/8-INCH DEEP

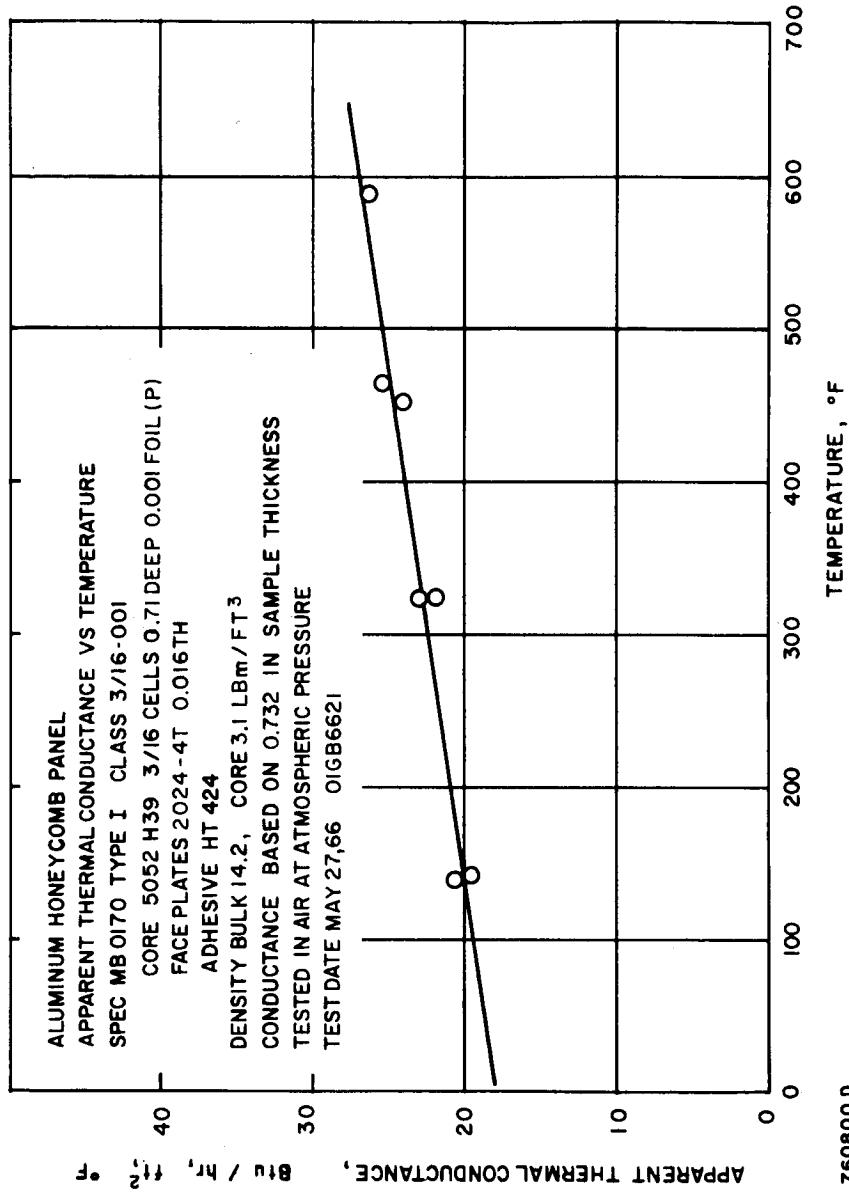


Figure 24 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM HONEYCOMB PANELS, 3/16-5052-H39-0.001P, 3/4-INCH DEEP

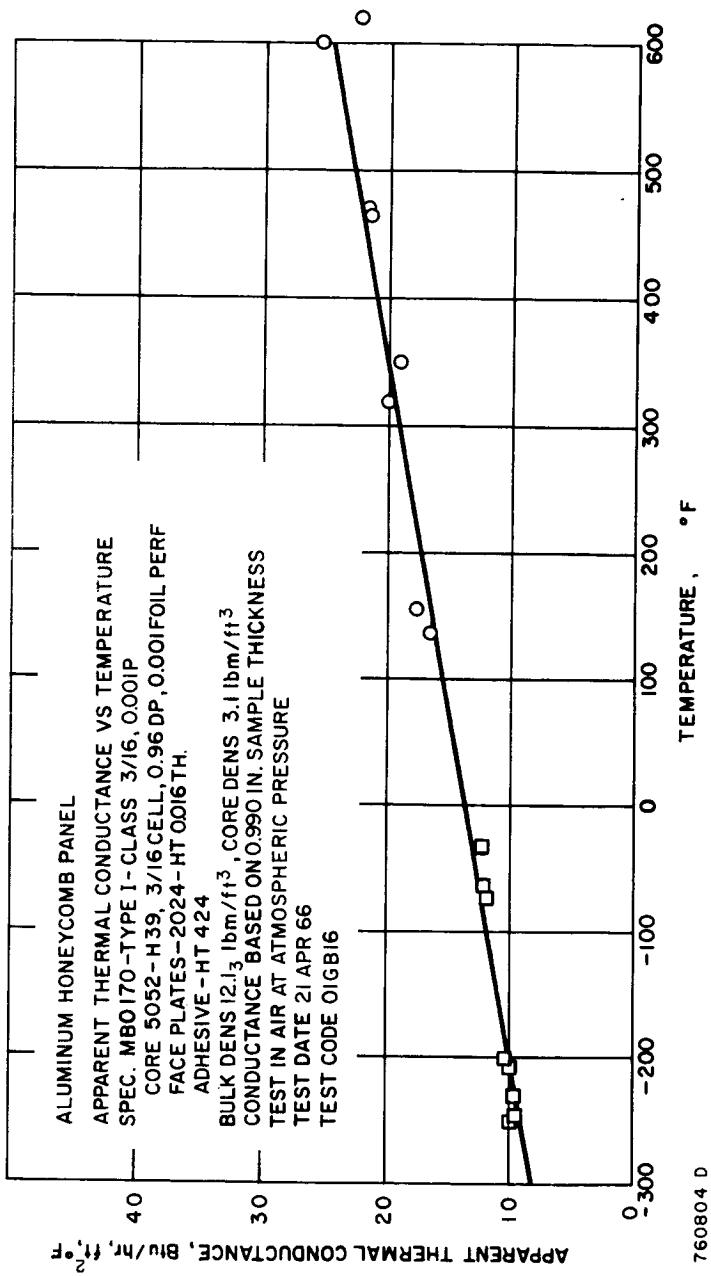


Figure 25 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
HONEYCOMB PANELS, 3/16-5052-H39-0.001P, 1 INCH DEEP

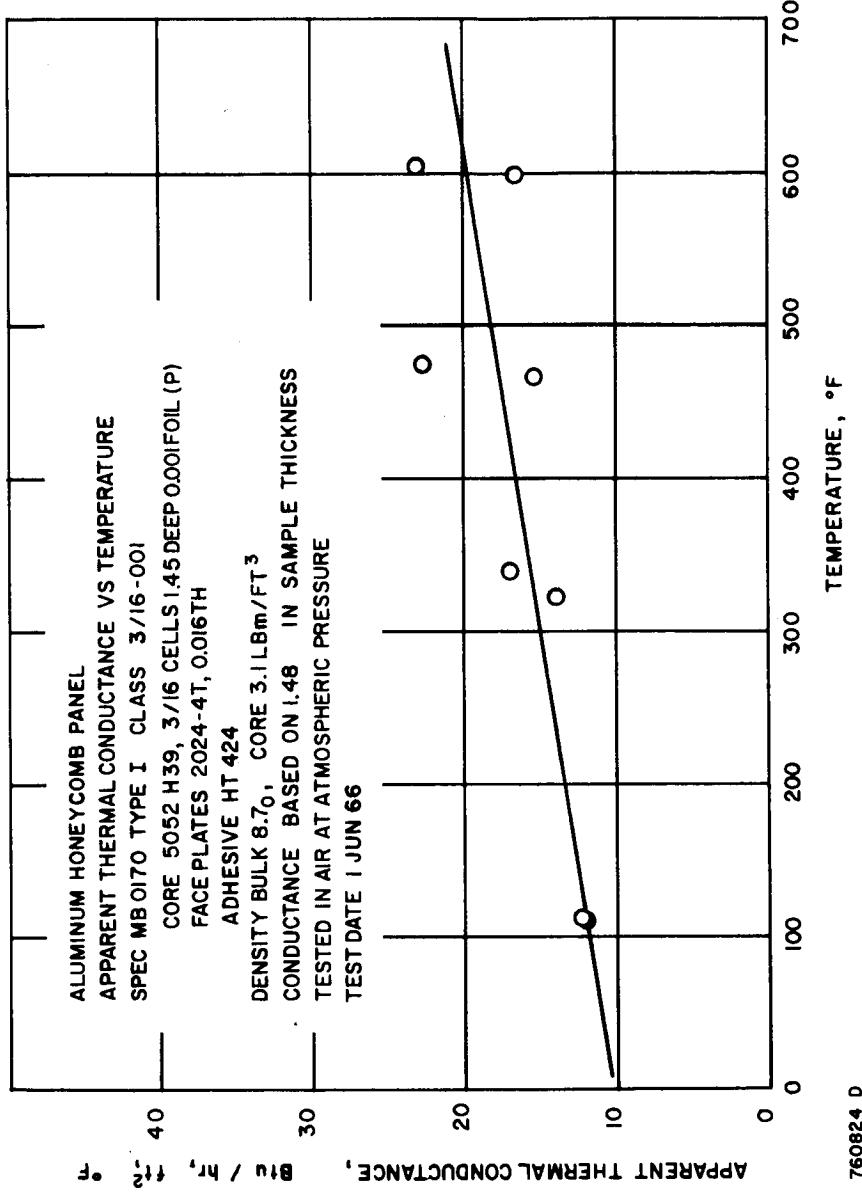


Figure 26 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
HONEYCOMB PANELS, 3/16-5052-H39-0.001P, 1.5 INCHES DEEP

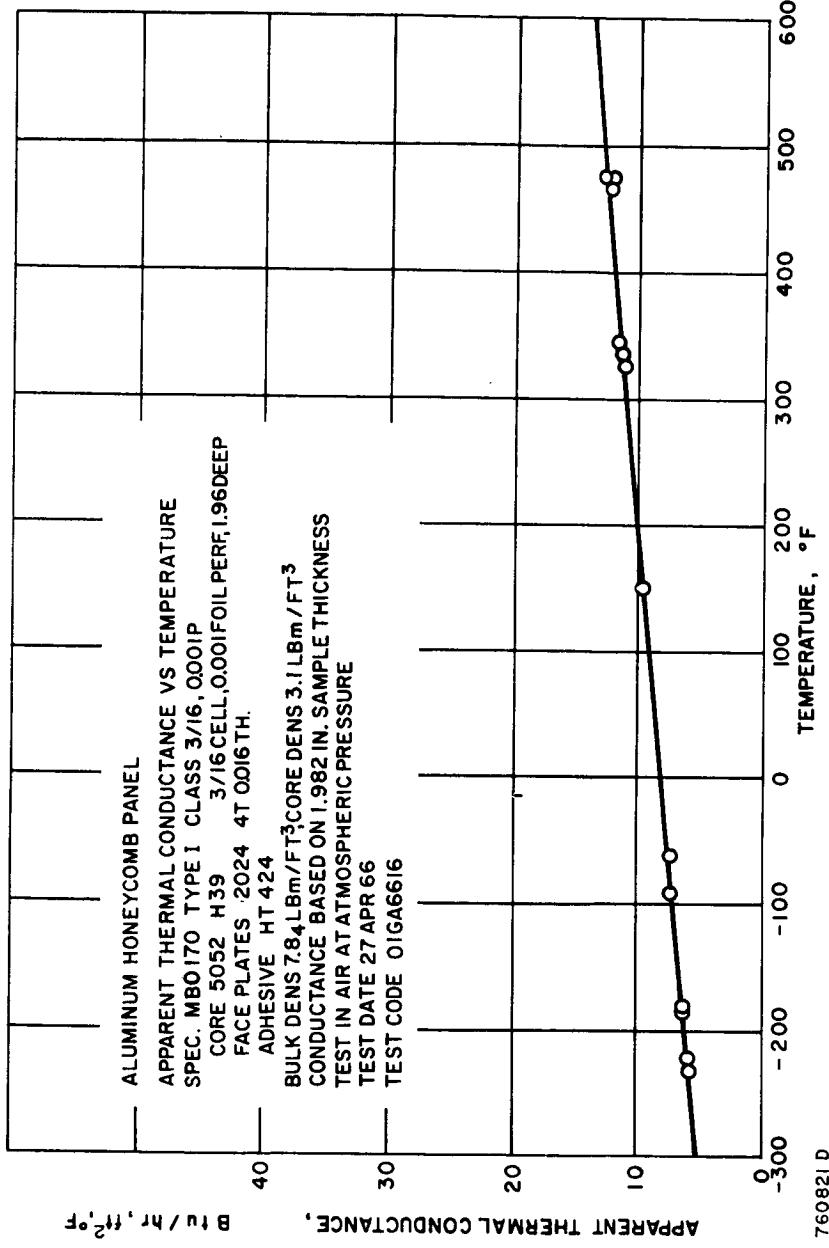


Figure 27 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
 HONEYCOMB PANELS, 3/16-5052-H39-0.001P, 2 INCHES DEEP

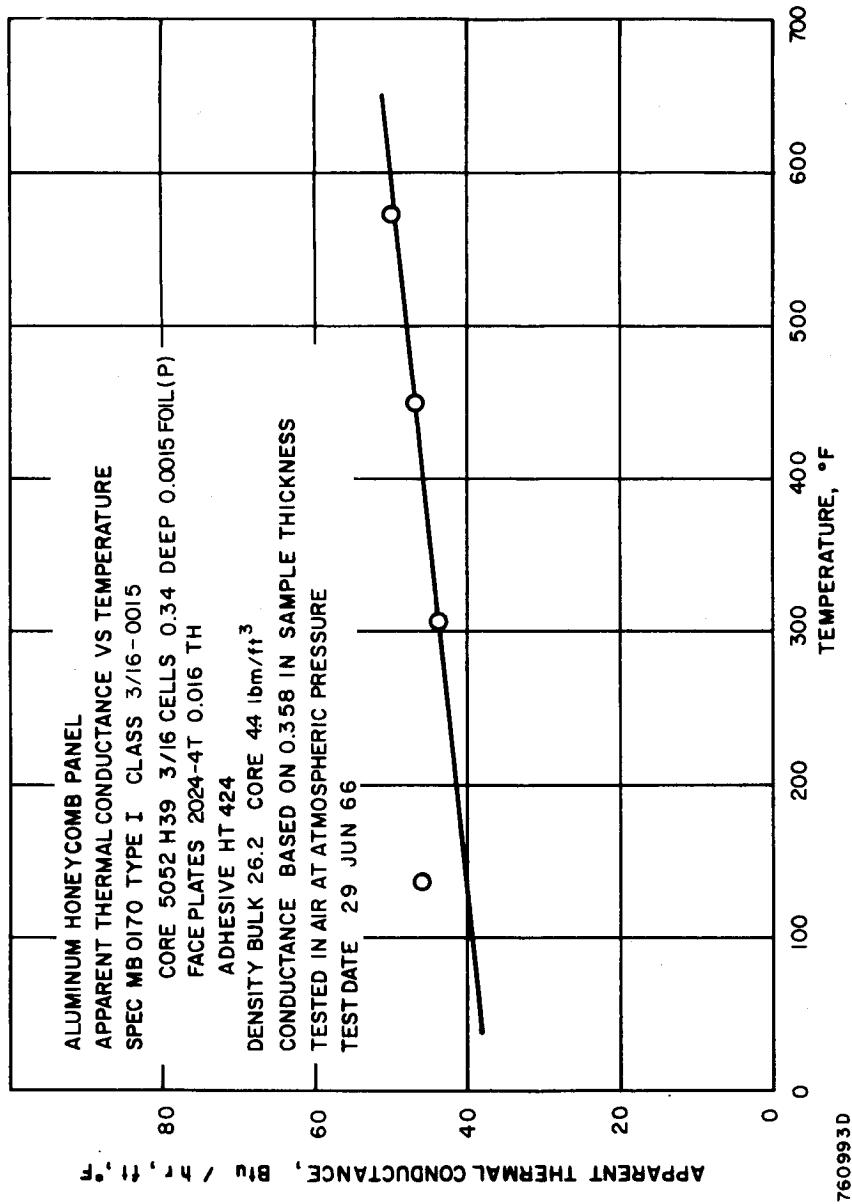


Figure 28 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
HONEYCOMB PANELS, 3/16-5052-H39-0.0015P, 3/8-INCH DEEP

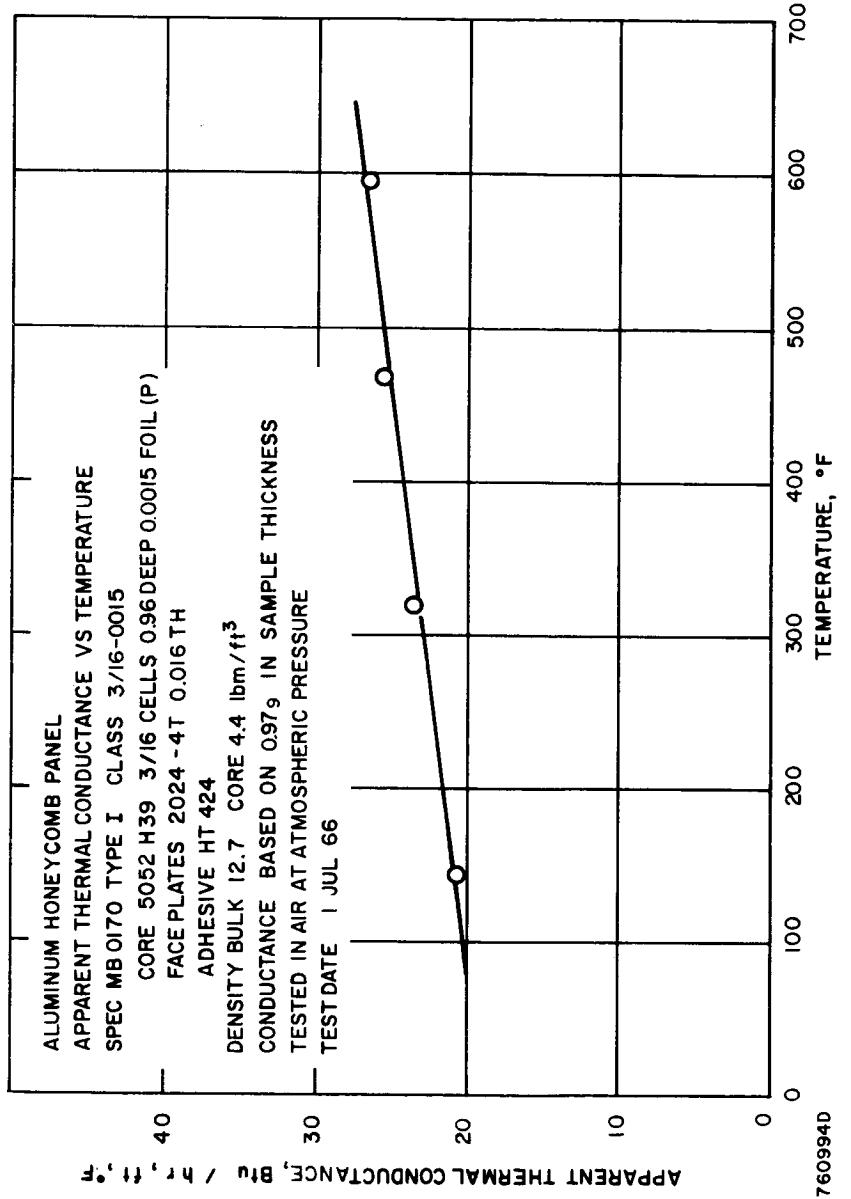


Figure 29 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
HONEYCOMB PANELS, 3/16-5052-H39-0.0015P, 1 INCH DEEP

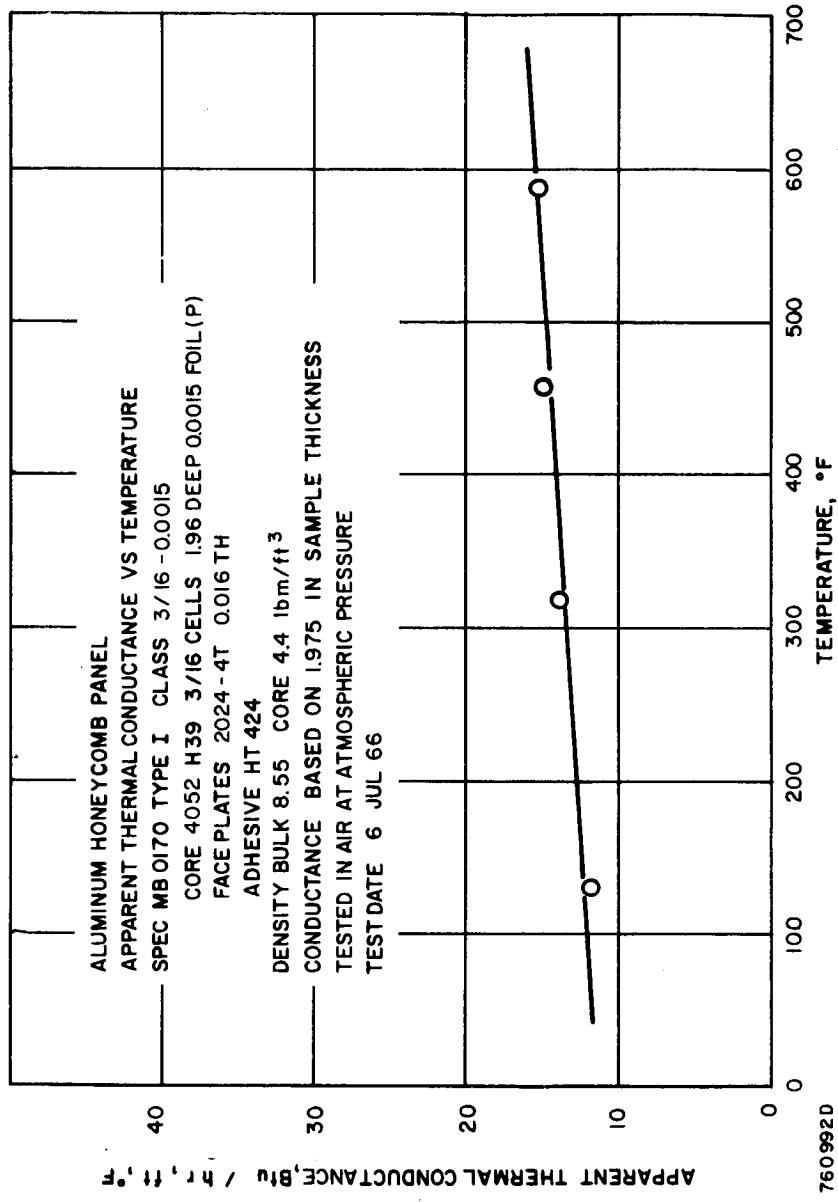


Figure 30 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM HONEYCOMB PANELS, 3/16-5052-H39-0.0015P, 2 INCHES DEEP

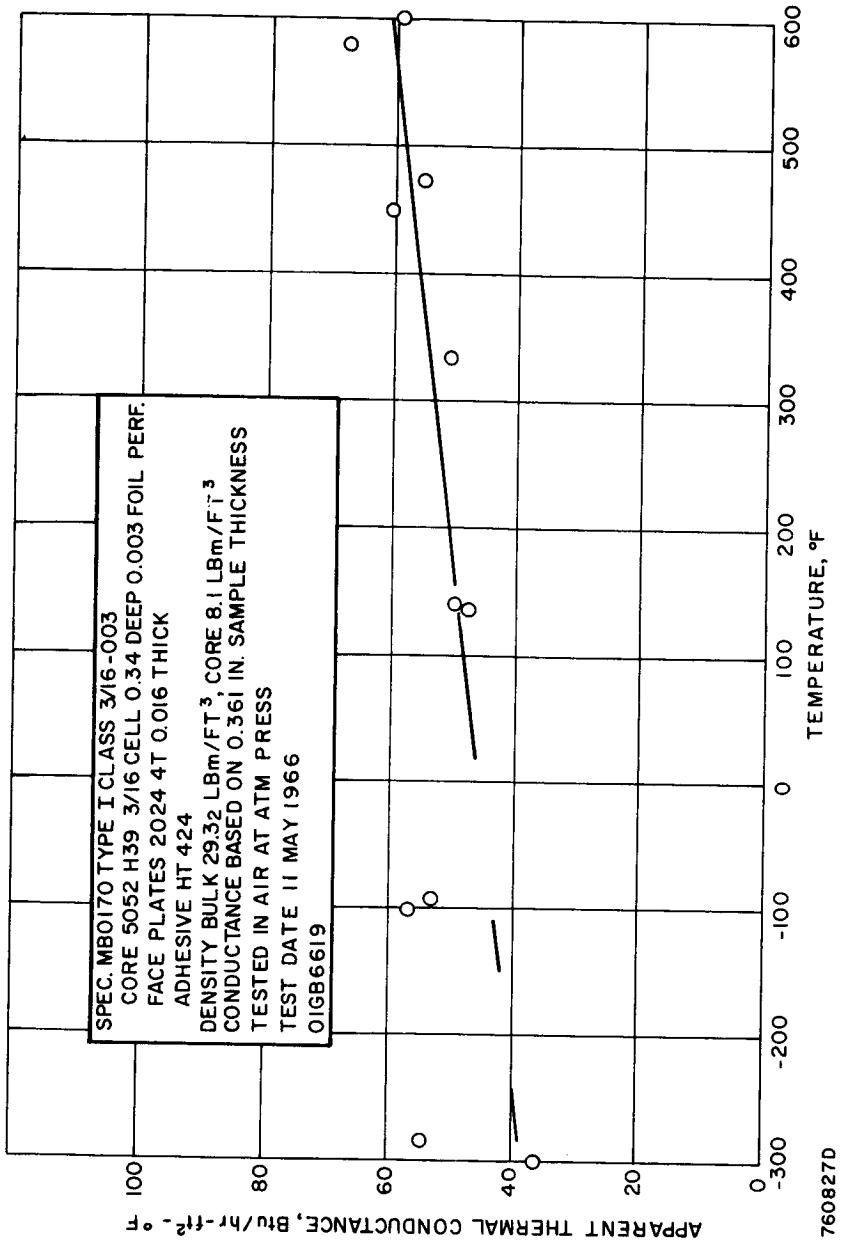


Figure 31 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
HONEYCOMB PANELS, 3 1/16-5052-H39-0.003P, 3.8-INCH DEEP

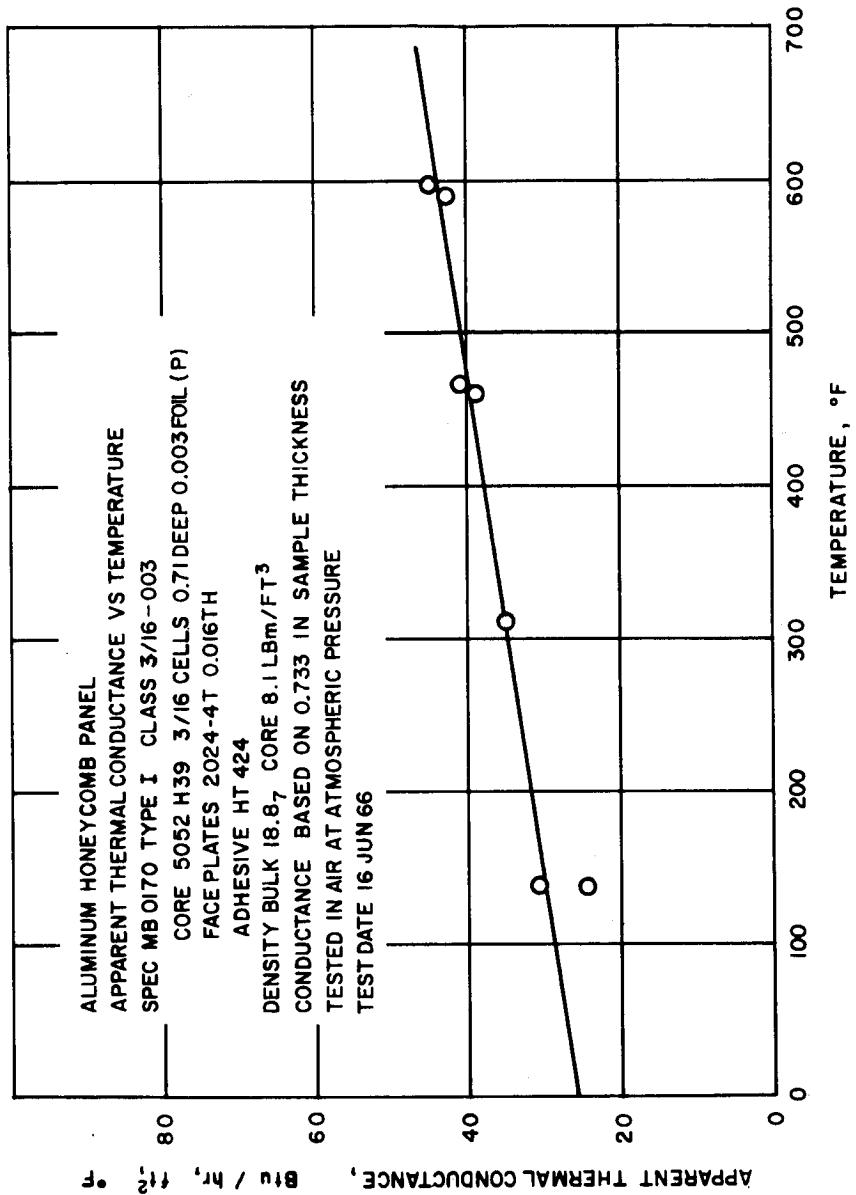


Figure 32 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM HONEYCOMB PANELS, 3/16-5052-H39-0.003P, 3/4-INCH DEEP

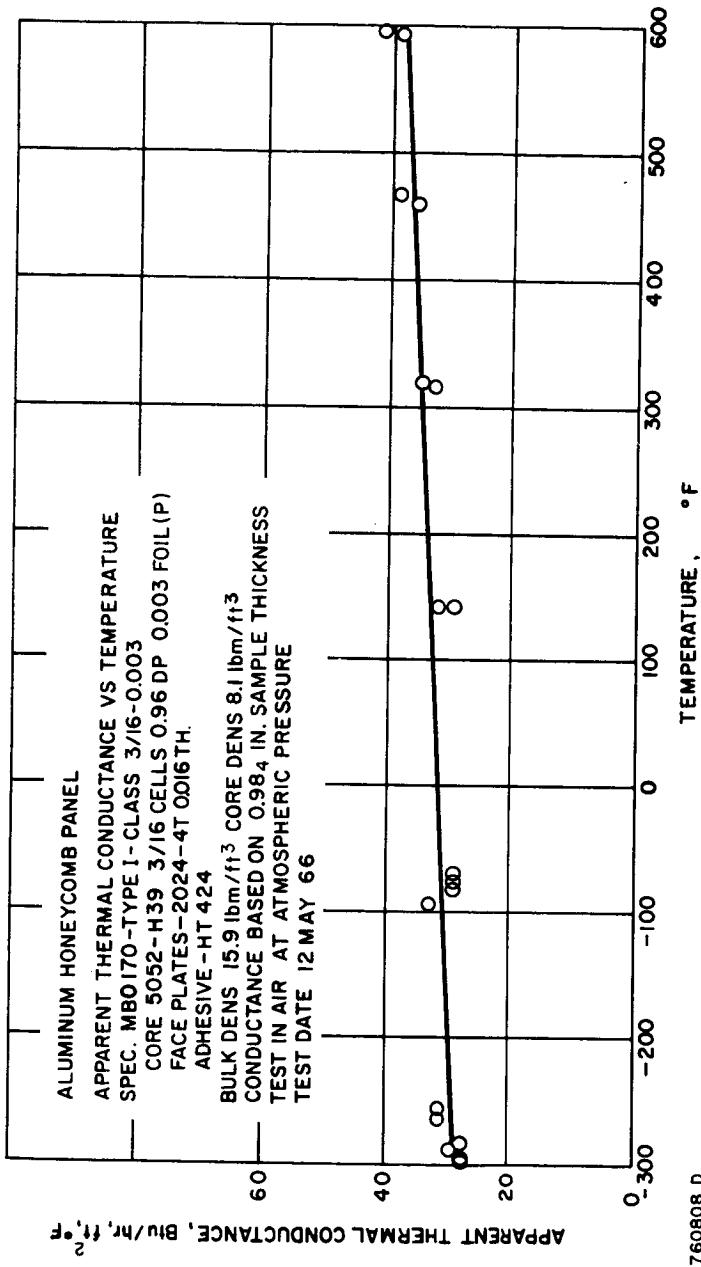


Figure 33 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
HONEYCOMB PANELS, 3/16-5052-H39-0.003P, 1 INCH DEEP

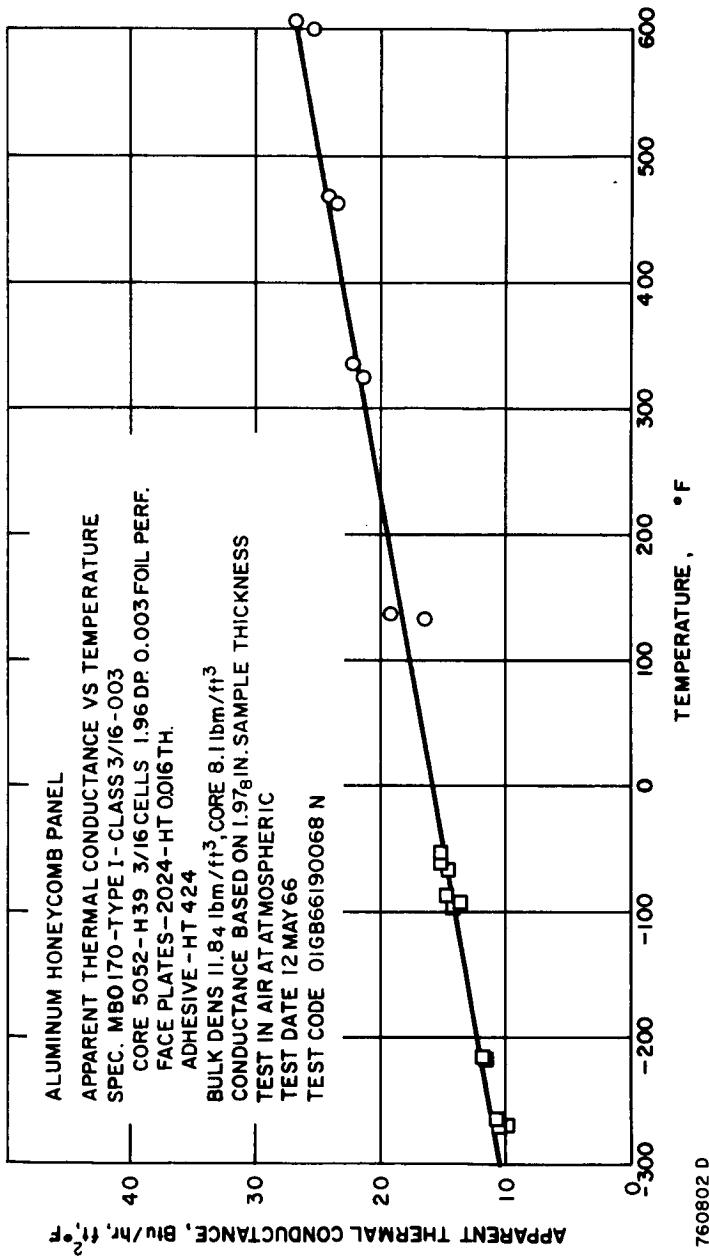


Figure 34 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
HONEYCOMB PANELS, 3/16-5052-H39-0.003P, 2 INCHES DEEP

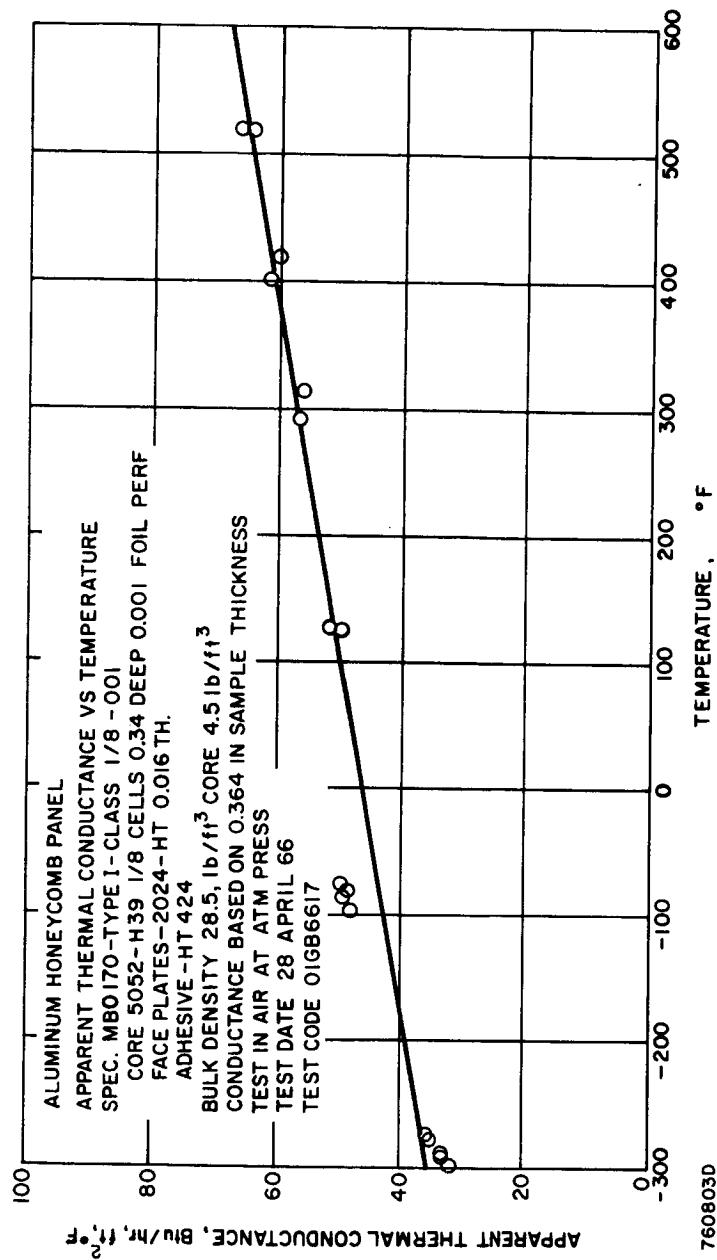


Figure 35 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
HONEYCOMB PANELS, 1/8-5052-H39-0.001 P, 3/8-INCH DEEP

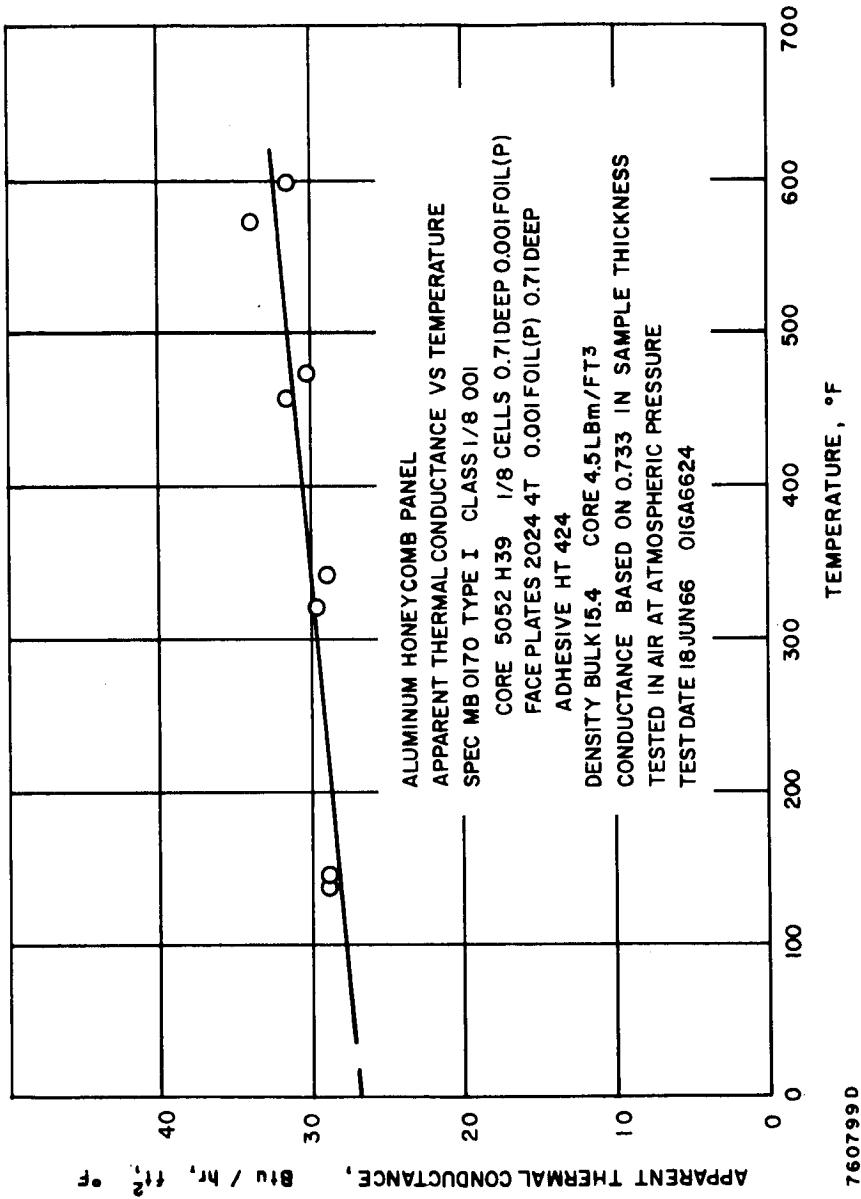


Figure 36 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
HONEYCOMB PANELS, 1/8-5052-H39-0.001P, 3/4-INCH DEEP

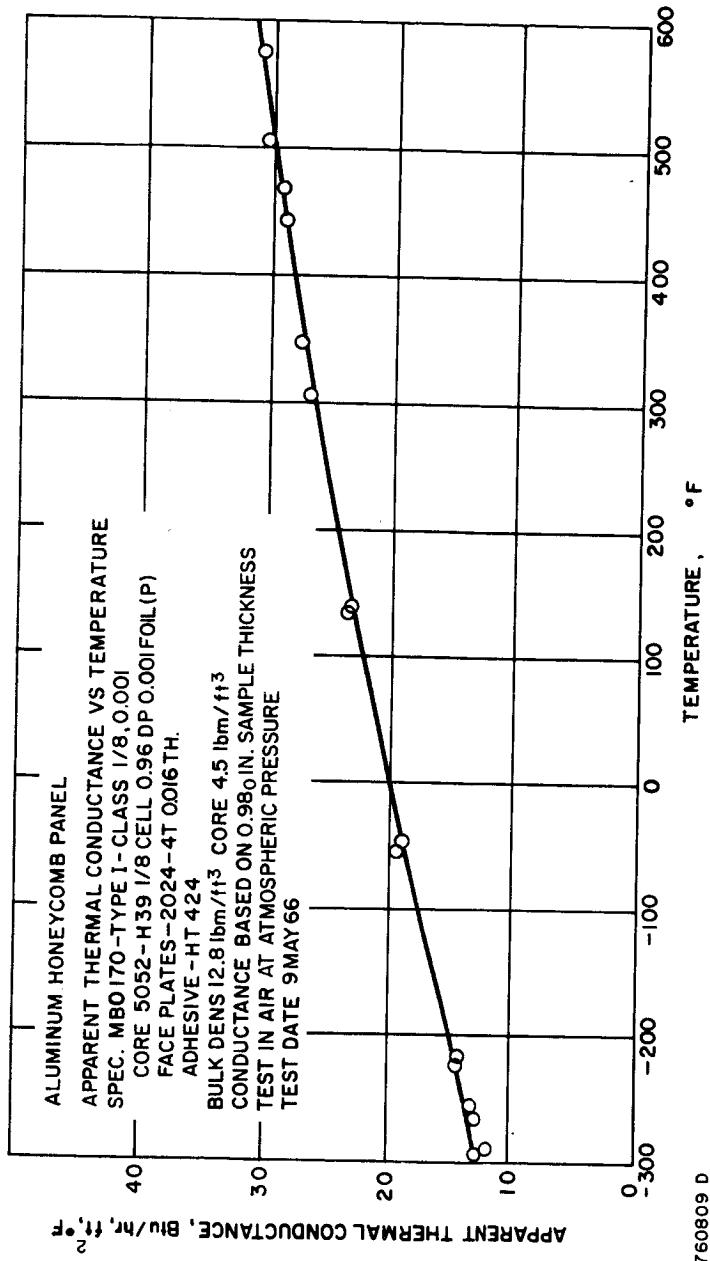


Figure 37 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM HONEYCOMB PANELS, 1/8-5052-H39 0.001P, 1 INCH DEEP

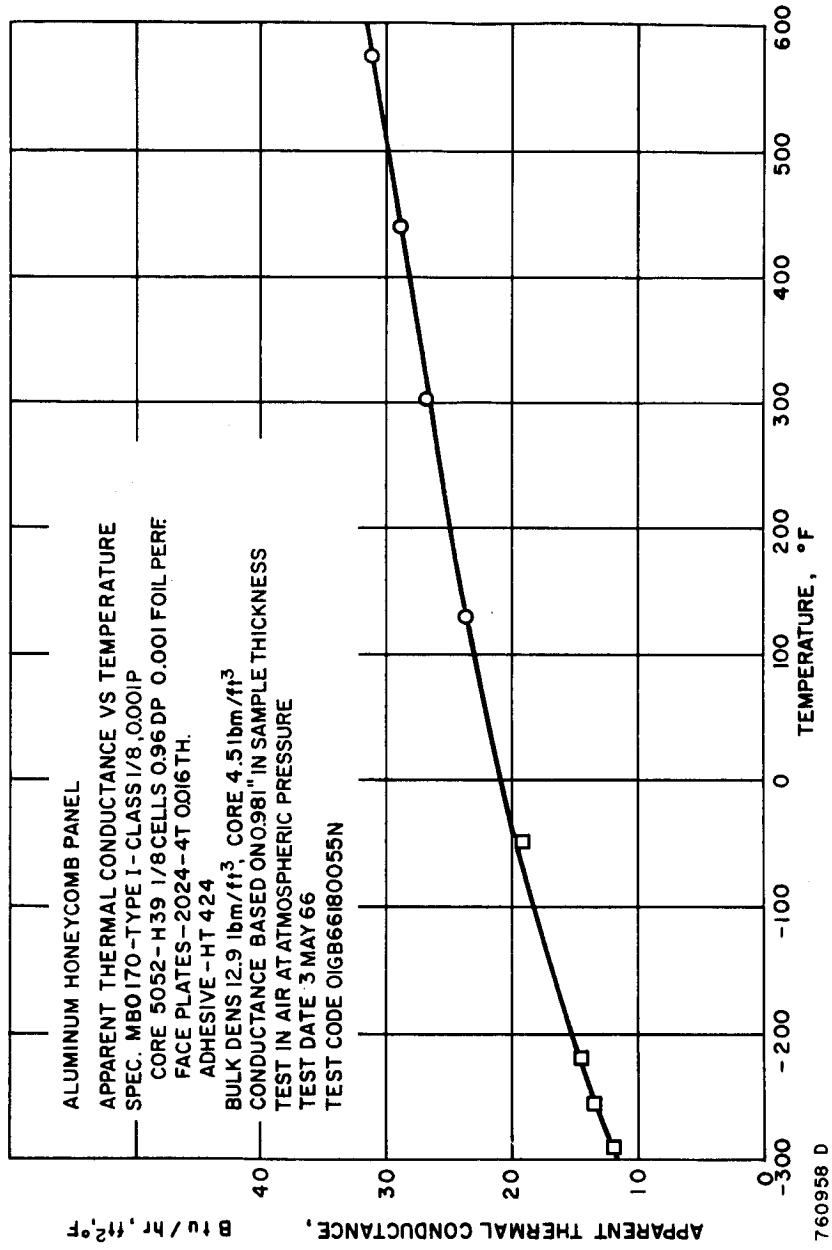


Figure 38 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM HONEYCOMB PANELS, 1/8-5052-H39-0.001P, 1 INCH DEEP

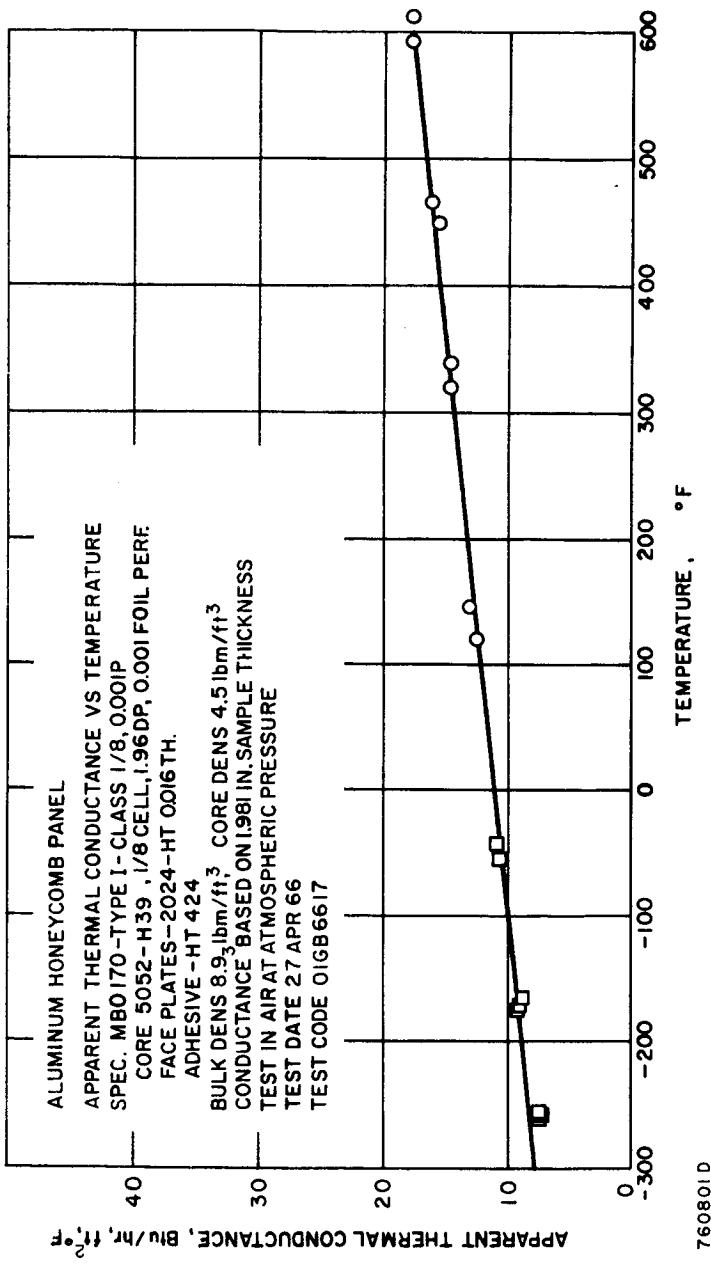


Figure 39 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM HONEYCOMB PANELS, 1/8-5052-H39-0.001P, 2 INCHES DEEP

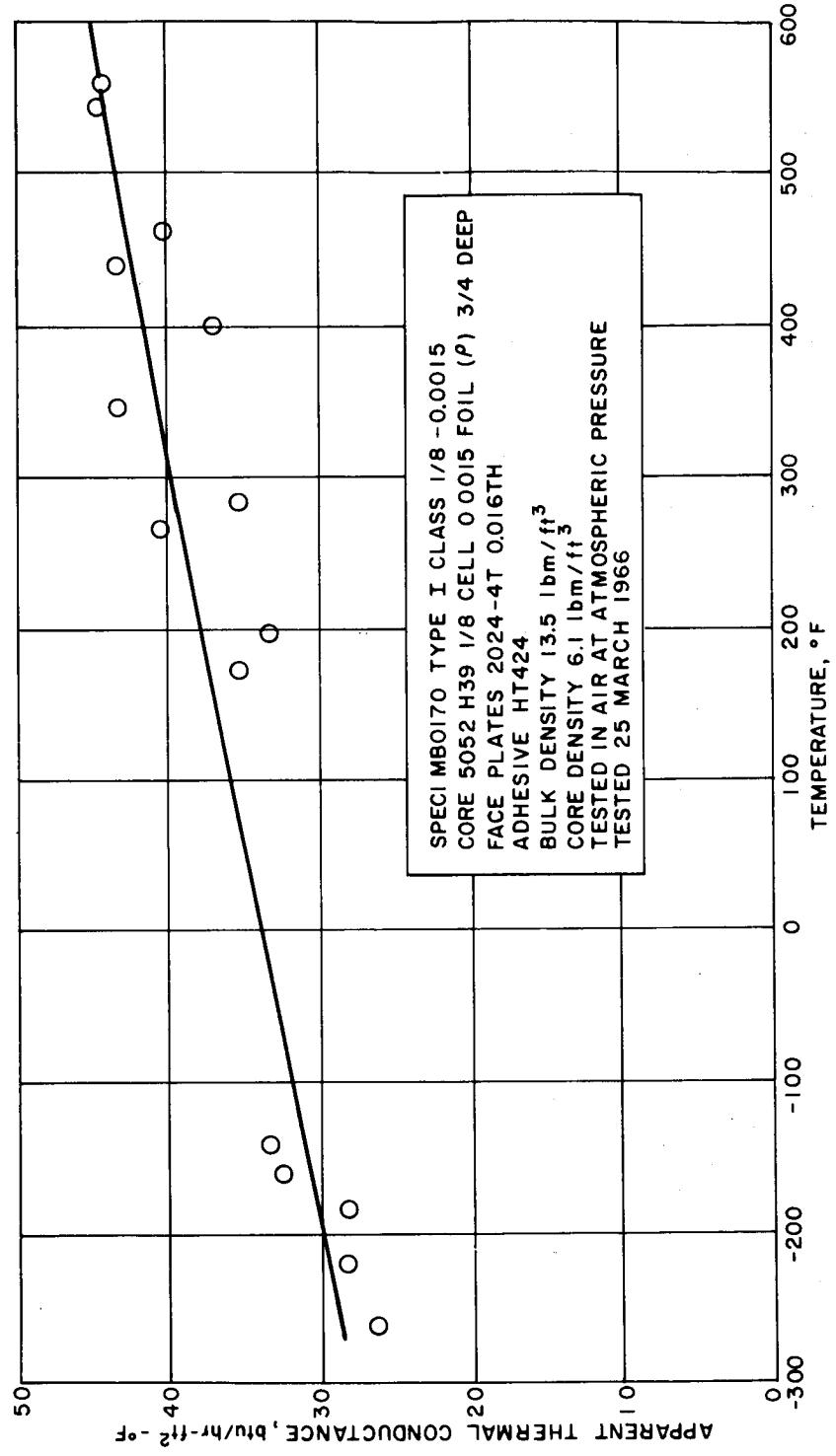


Figure 40 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
HONEYCOMB PANELS, 1/8-5052-H39-0.0015P, 3/4-INCH DEEP

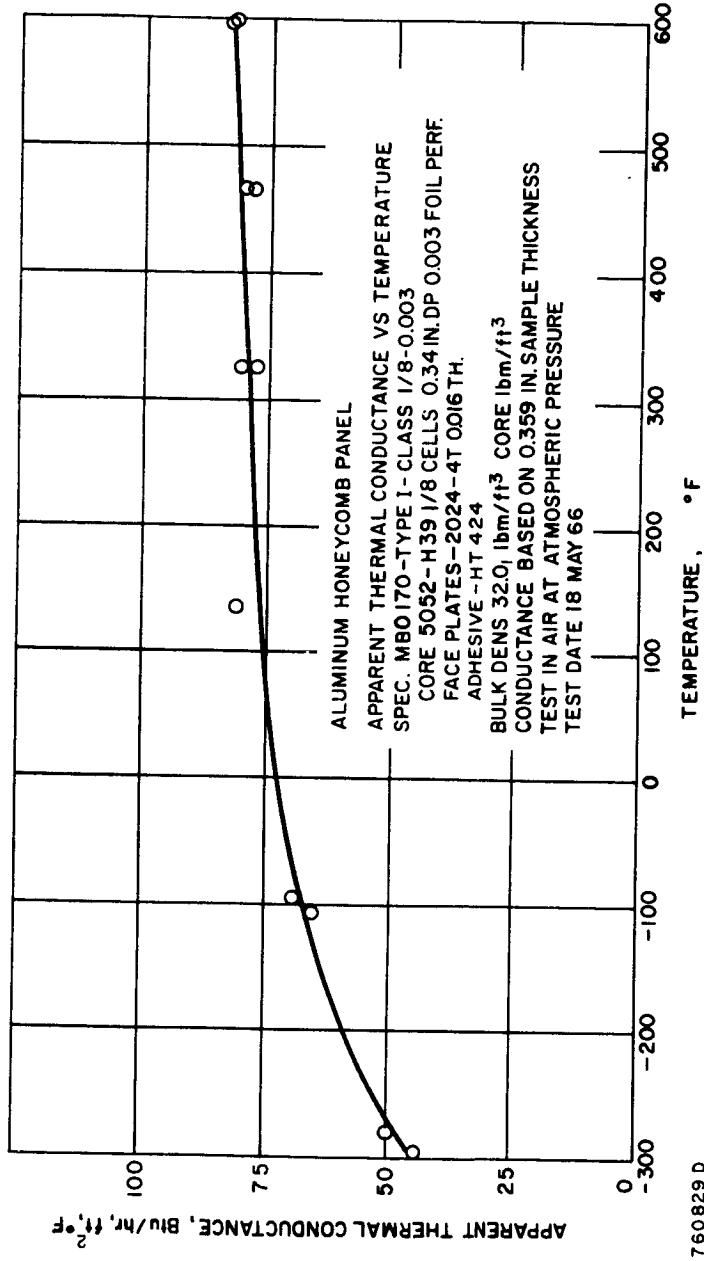


Figure 41 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
HONEYCOMB PANELS, 1/8-5052-H39-0.003P, 3/8-INCH DEEP

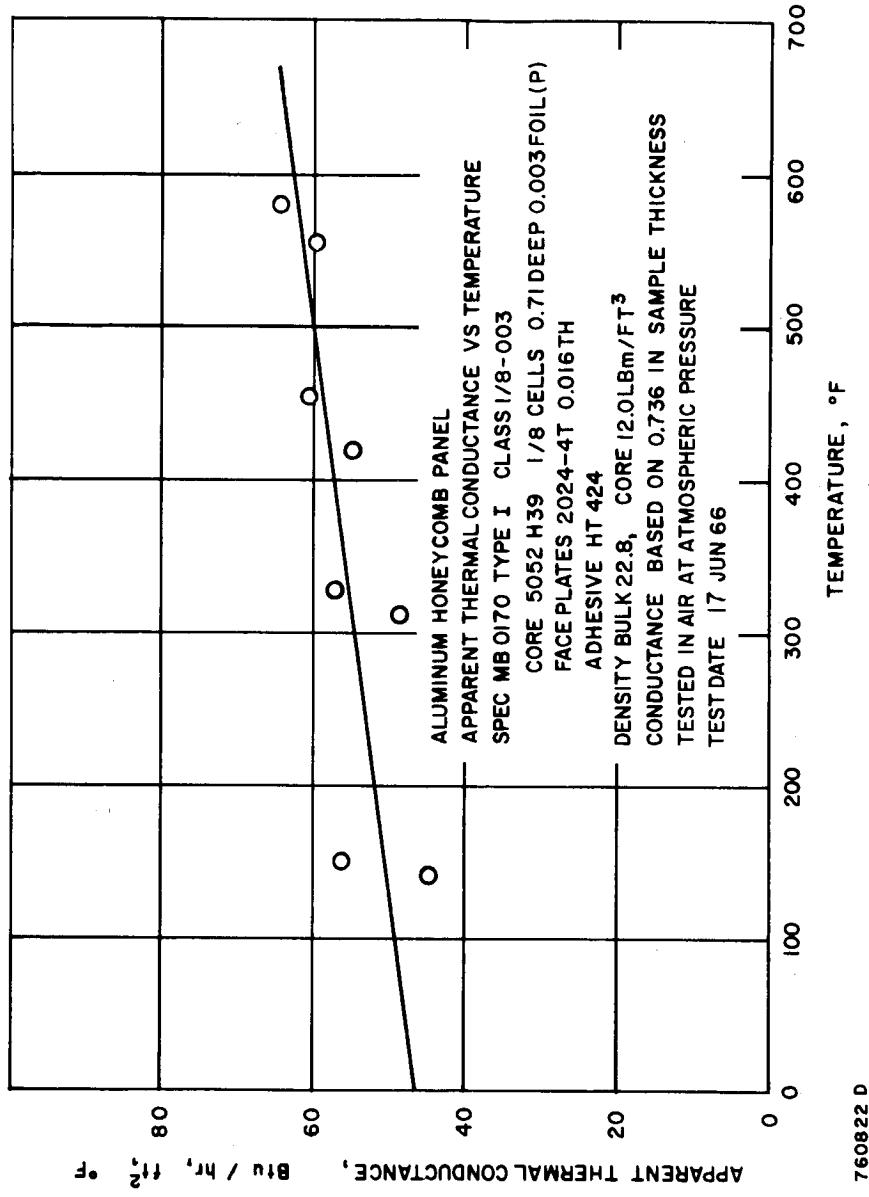


Figure 42 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM HONEYCOMB PANELS, 1/8-5052-H39-0.003P, 3/4-INCH DEEP

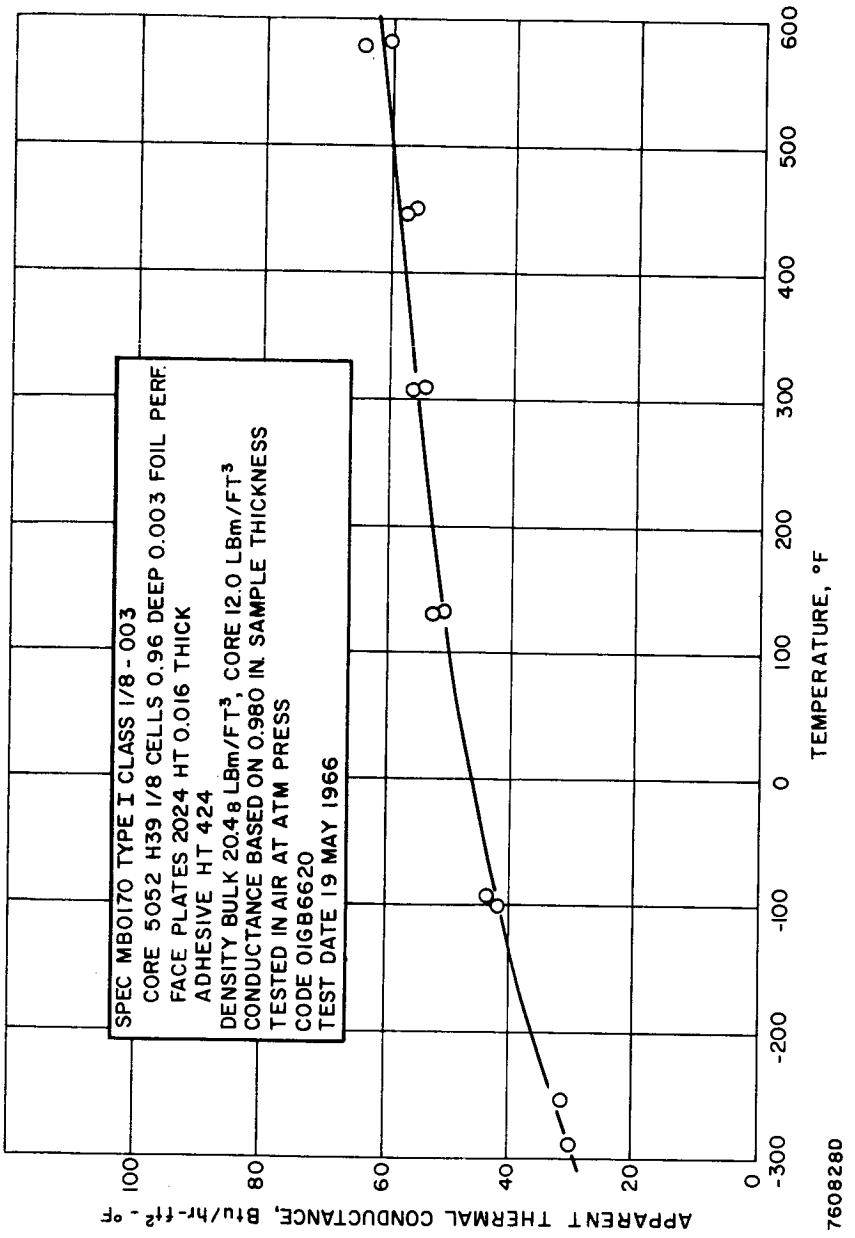


Figure 43 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
HONEYCOMB PANELS, 1/8-5052-H39-0.003P, 1 INCH DEEP

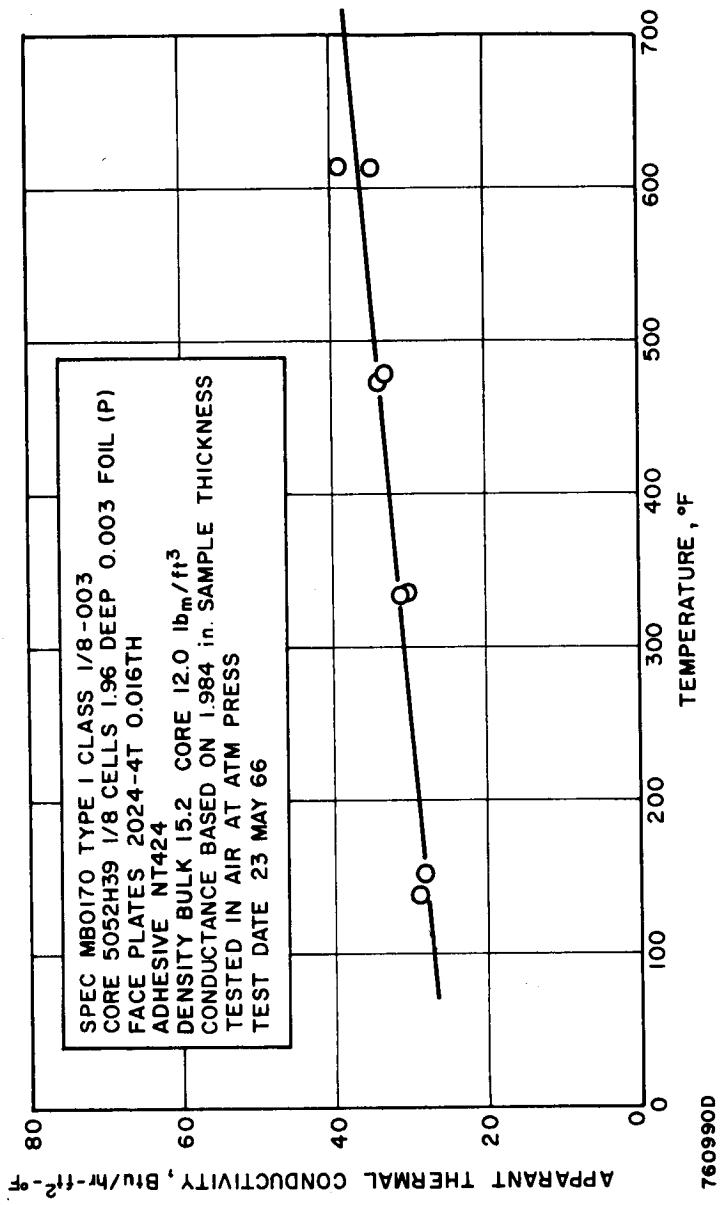


Figure 44 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM HONEYCOMB PANELS, 1/8-5052-H39-0.003P, 2 INCHES DEEP

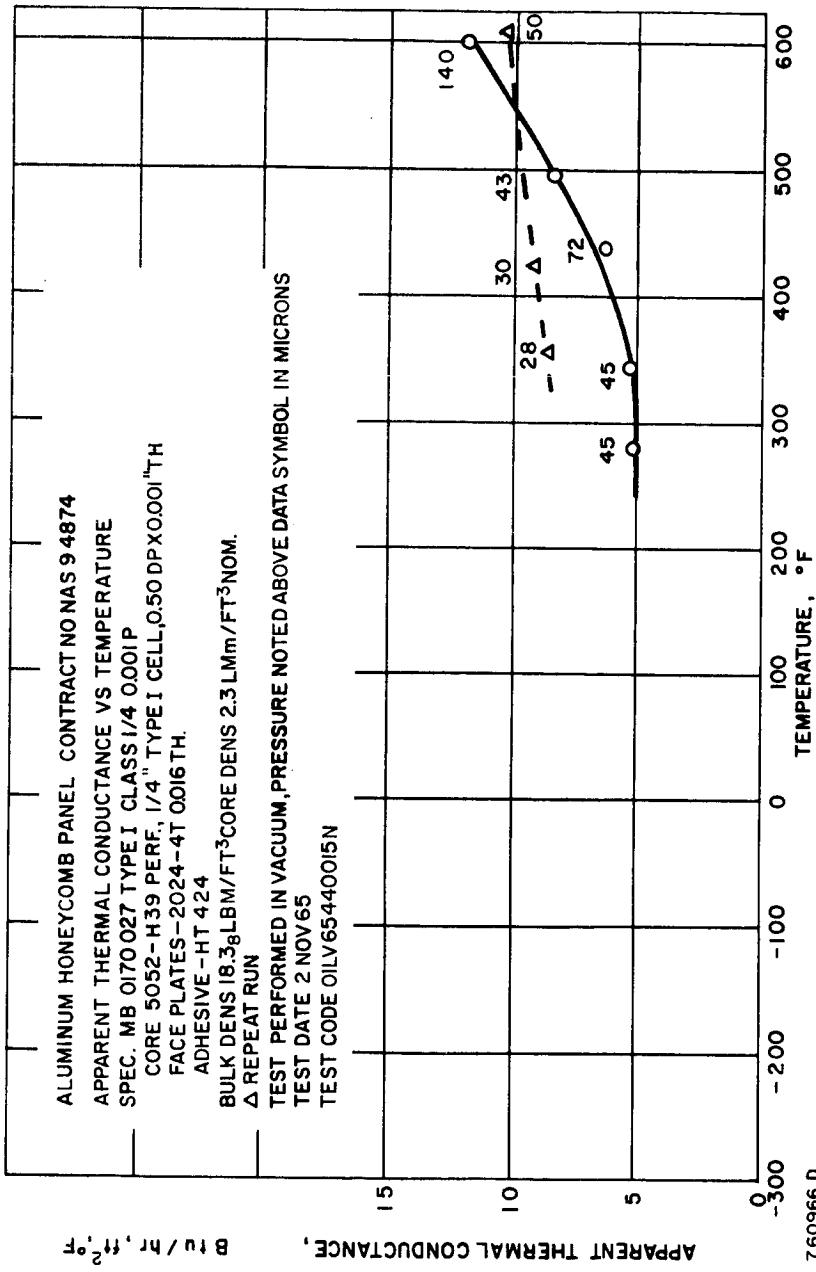


Figure 45 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM HONEYCOMB PANELS, 1/4-5052-H39-0.001P, 1/2-INCH DEEP (VACUUM)

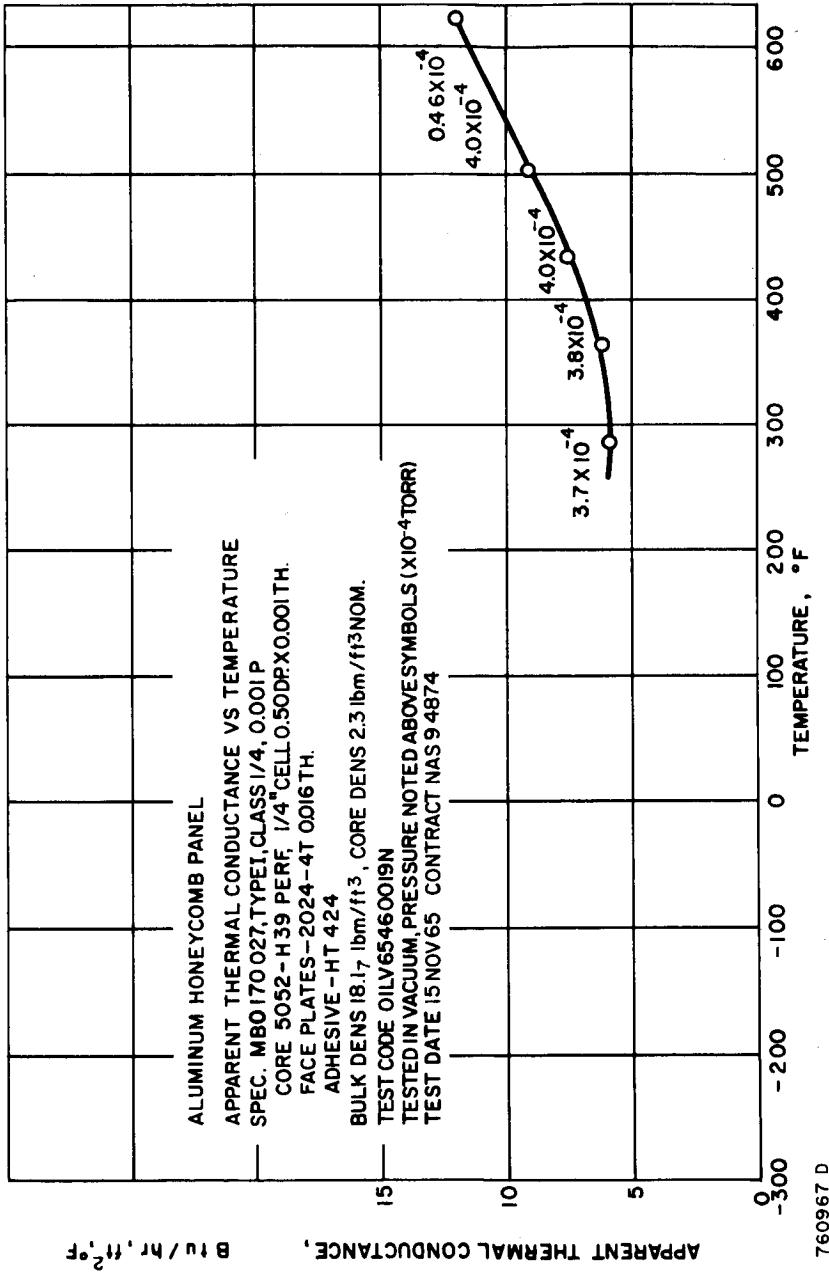


Figure 46 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM HONEYCOMB PANELS, 1/4-5052-H39-0.001P, 1/2-INCH DEEP (VACUUM)

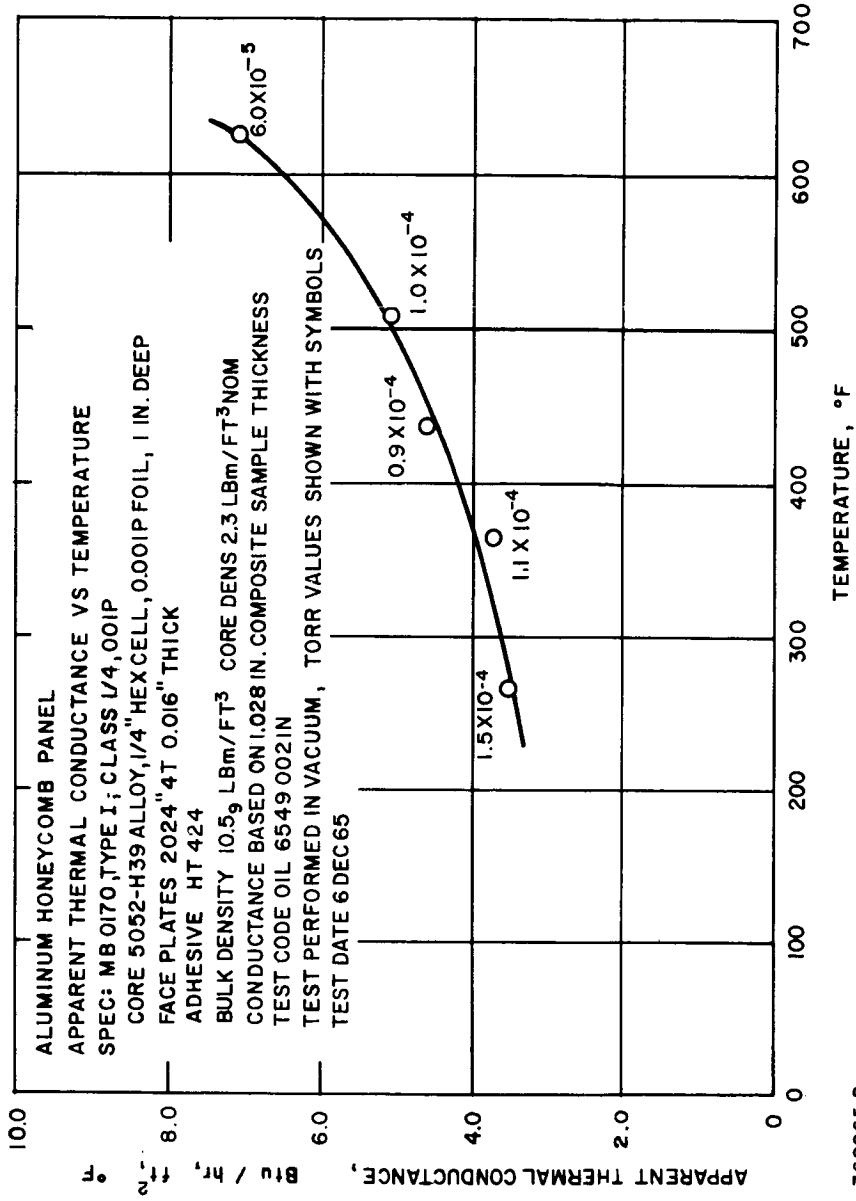


Figure 47 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM HONEYCOMB PANELS, 1/4-5052-H39-0.001P, 1 INCH DEEP (VACUUM)

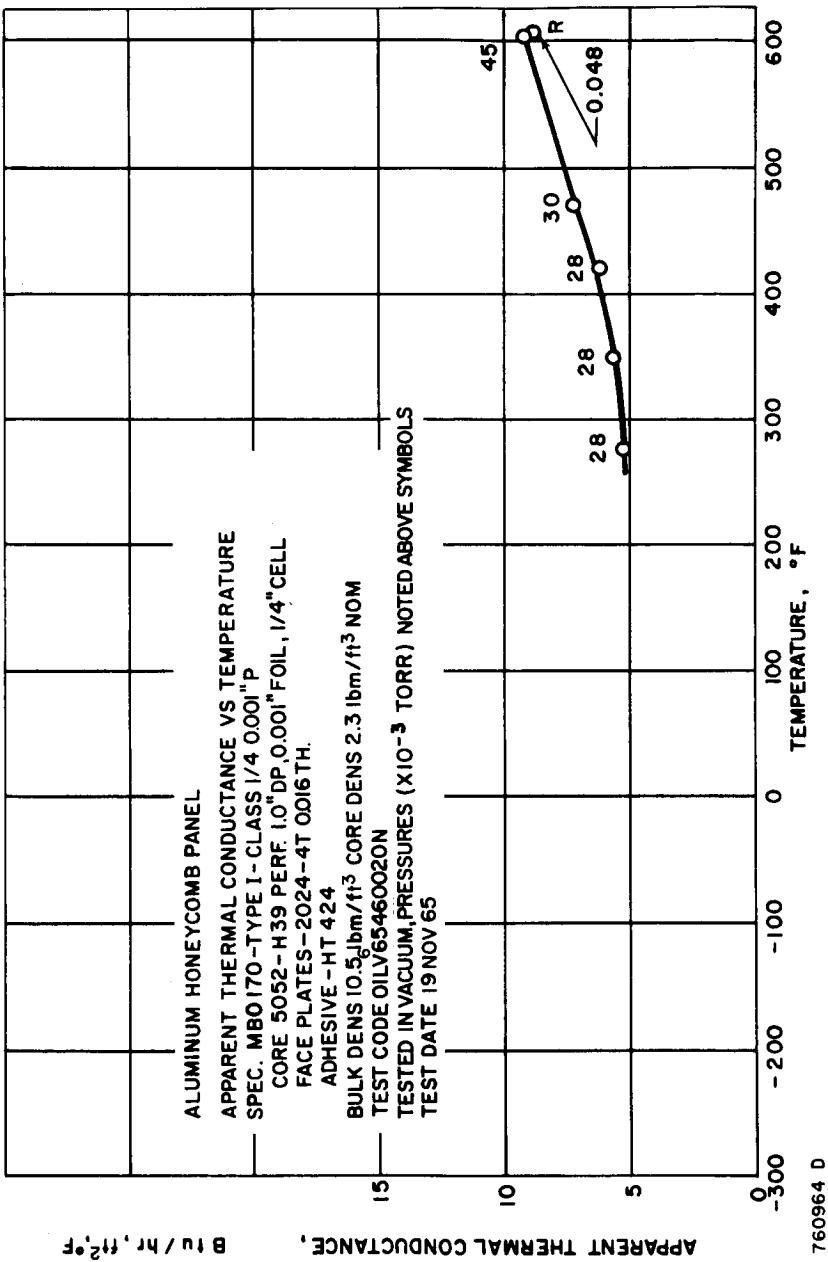


Figure 48 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
HONEYCOMB PANELS, 1/4-5052-H39-0.001P, 1 INCH DEEP (VACUUM)

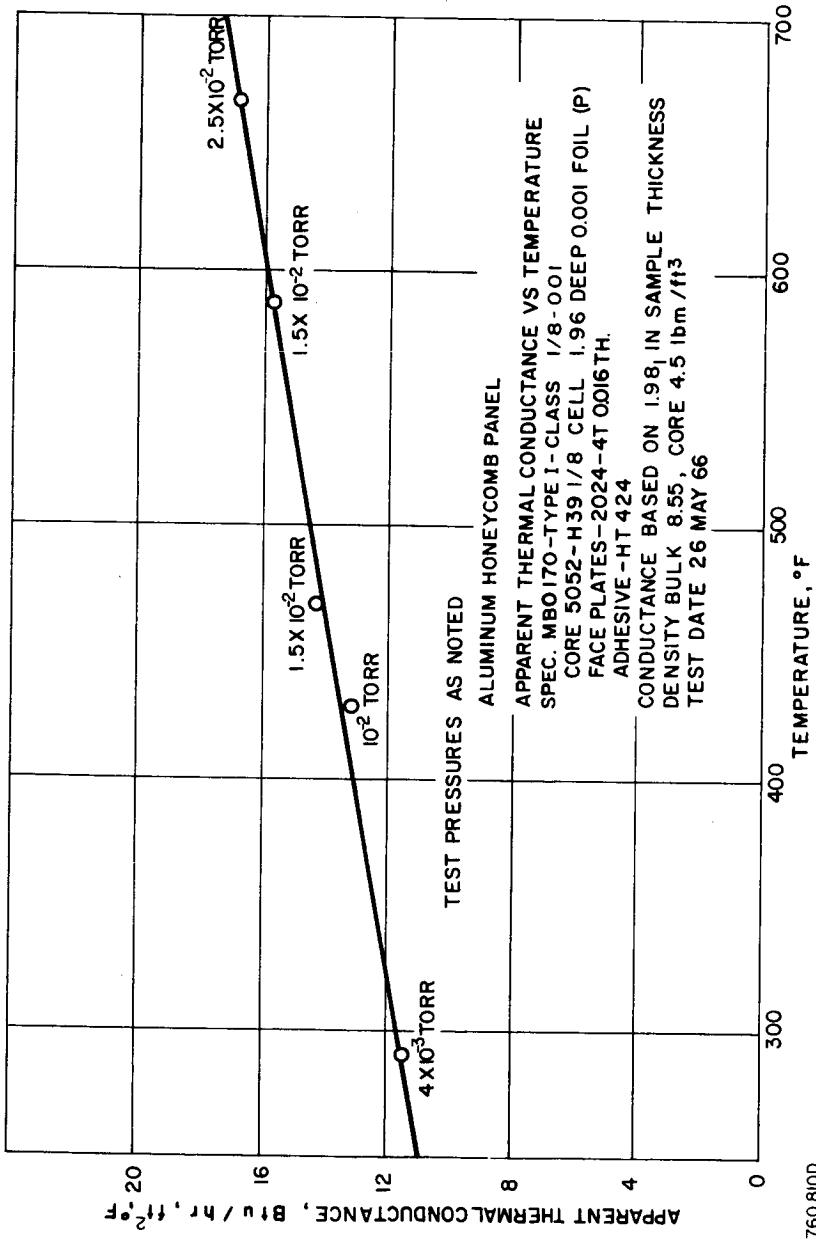


Figure 49 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM HONEYCOMB PANELS, 1/8-5052-H39-0.001P, 2 INCHES DEEP (VACUUM)

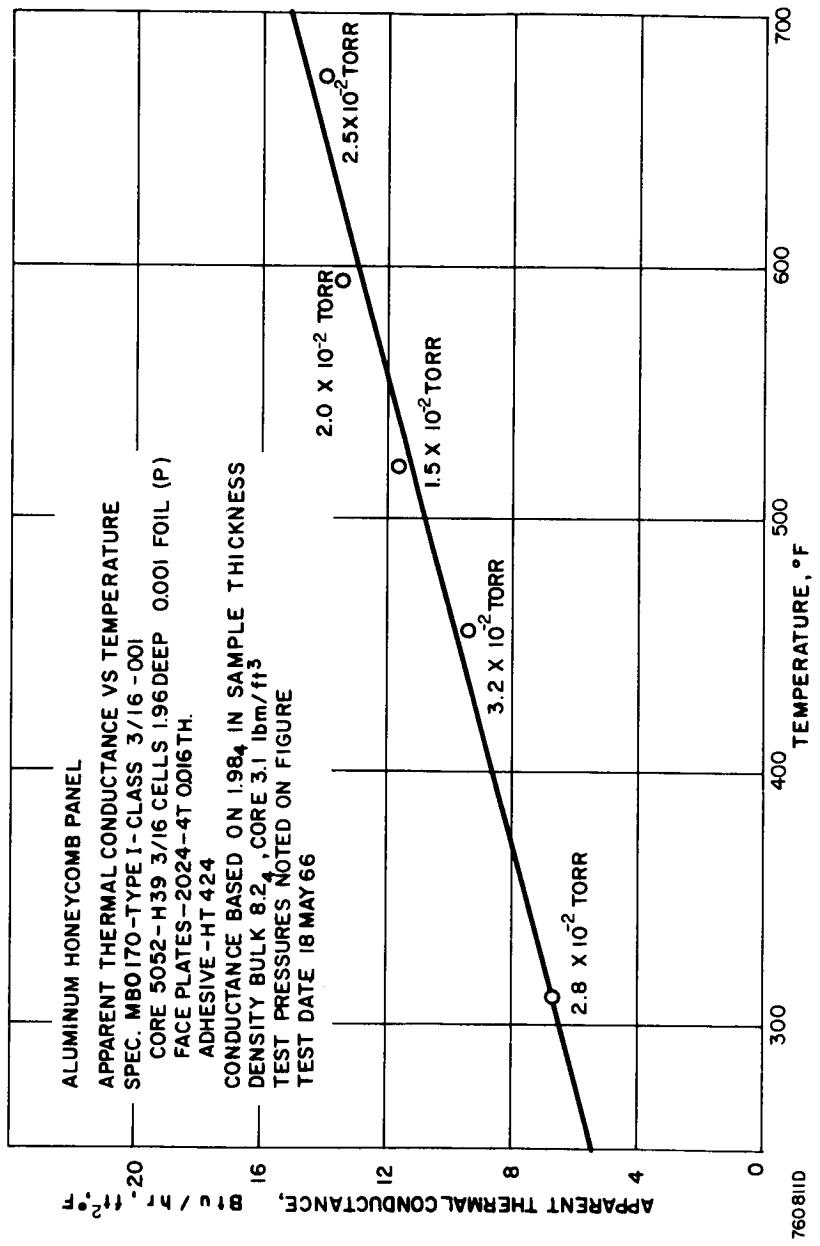


Figure 50 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM HONEYCOMB PANELS, 3/16-5052-H39-0.001P, 2 INCHES DEEP (VACUUM)

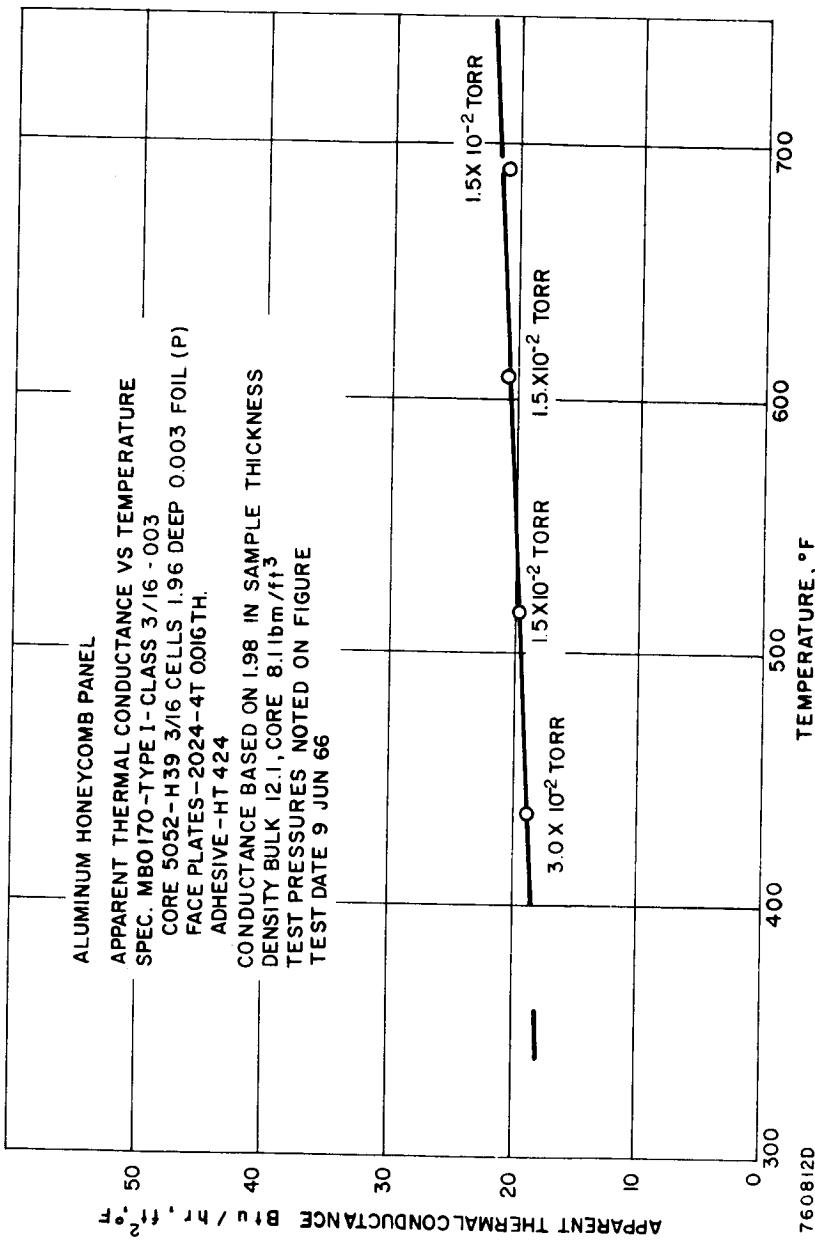


Figure 51 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM  
HONEYCOMB PANELS, 3/16-5052-H39-0.003P, 2 INCHES DEEP (VACUUM)

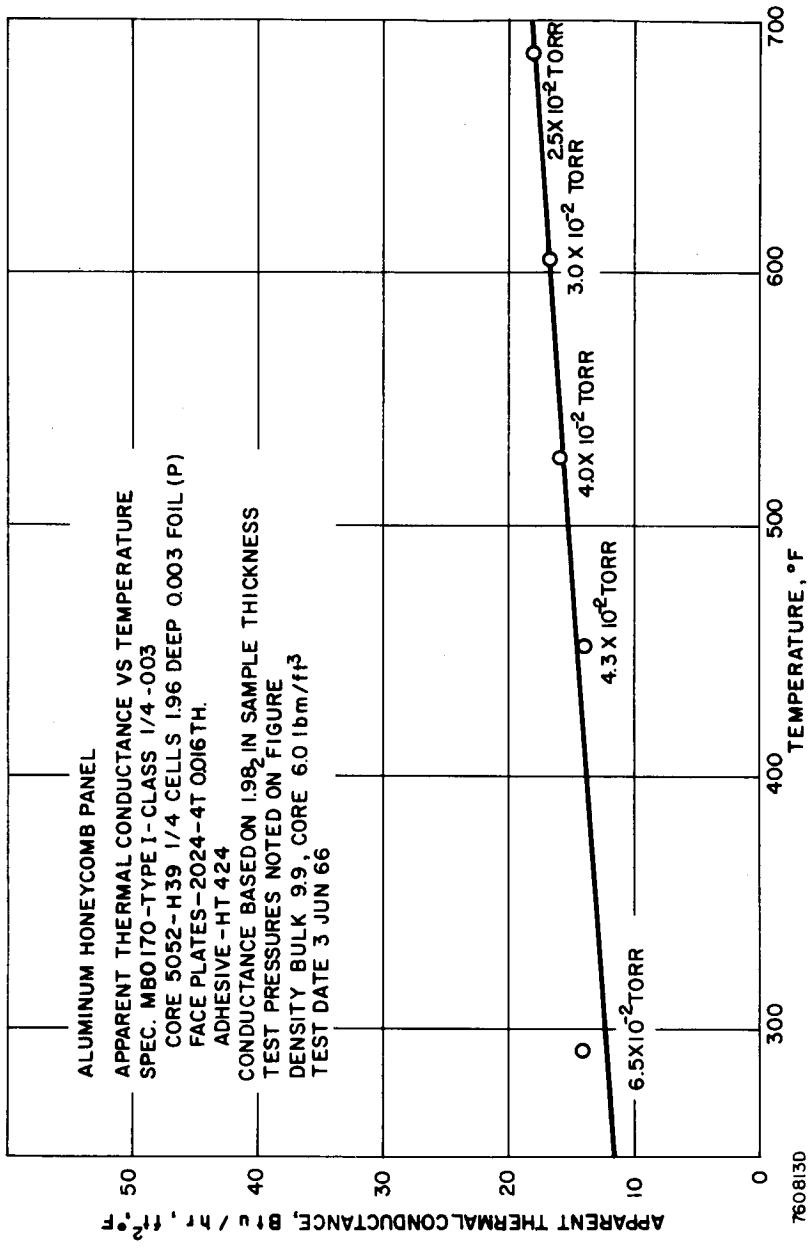


Figure 52 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM HONEYCOMB PANELS, 1/4-5052-H39-0.003P, 2 INCHES DEEP (VACUUM)

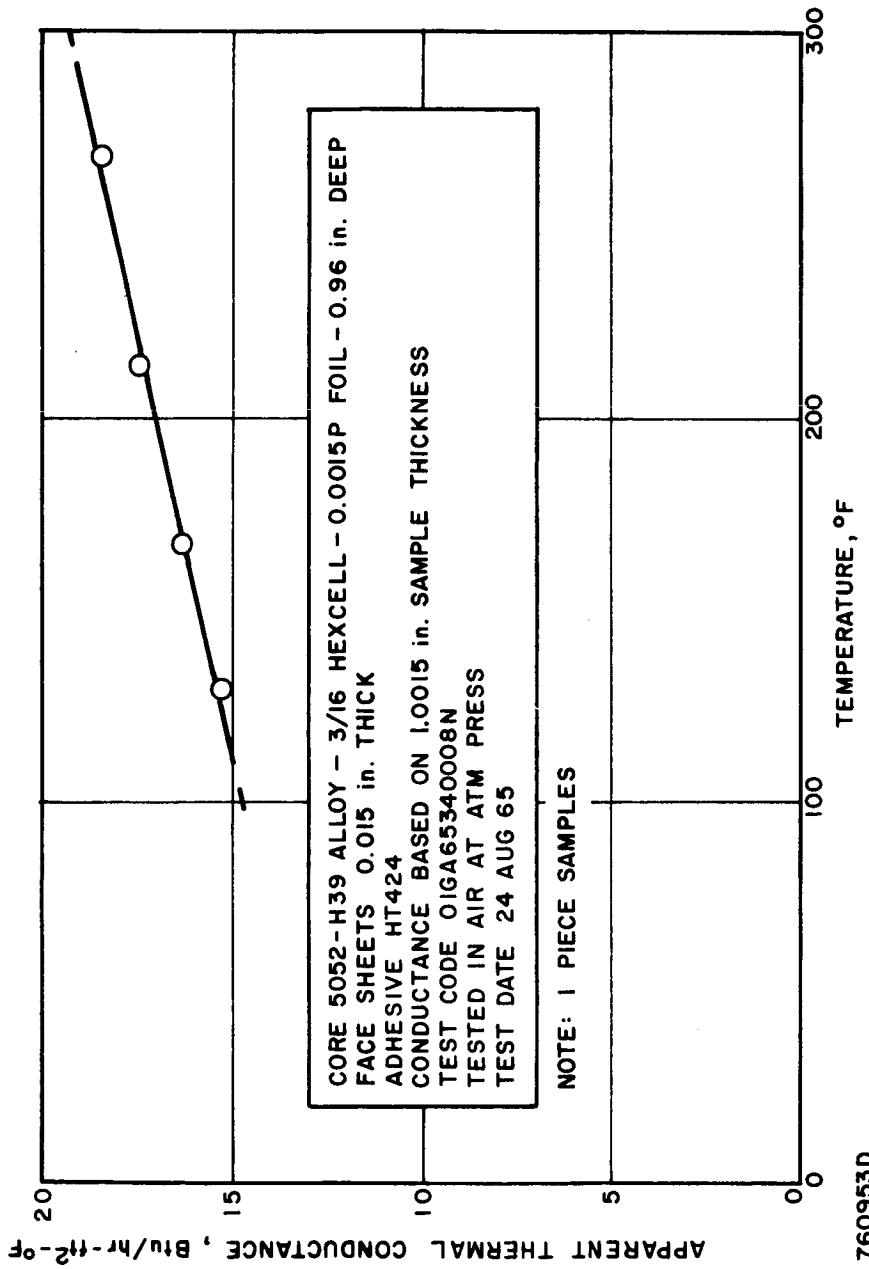


Figure 53 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM HONEYCOMB PANELS, 3/16-5052-H39-0.0015P, 1 INCH DEEP (TS 501)

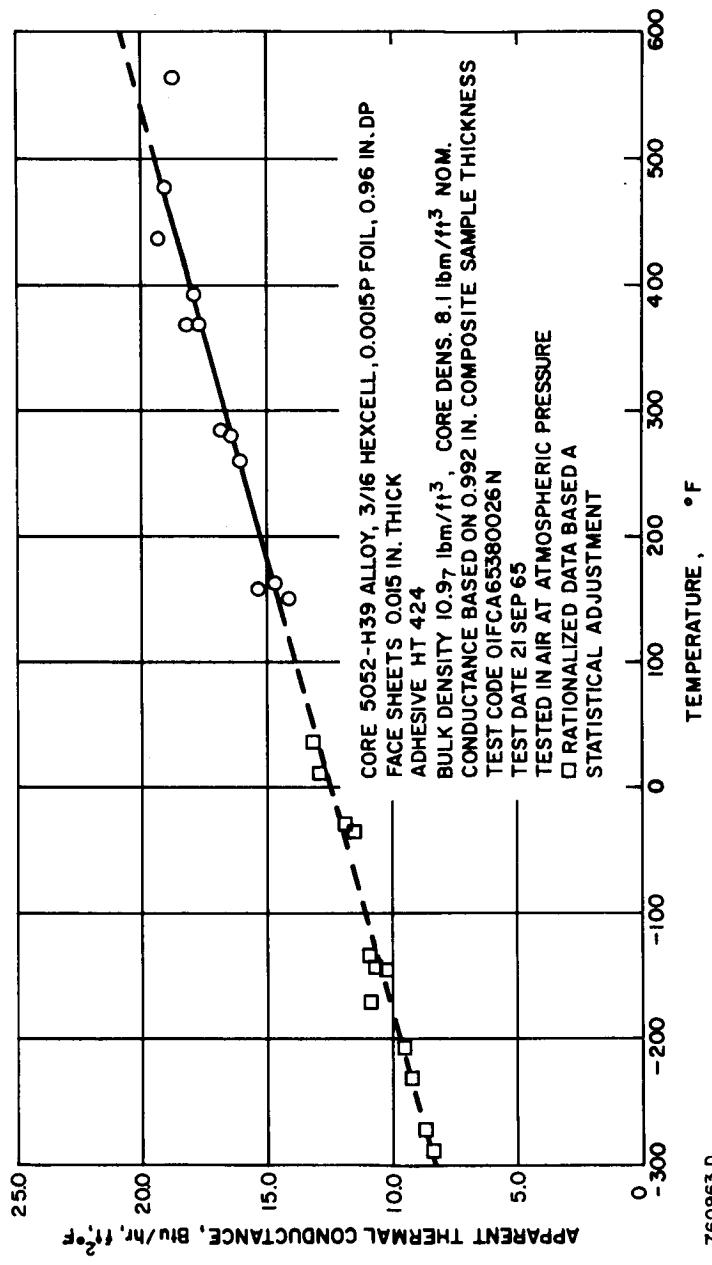


Figure 54 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, ALUMINUM HONEYCOMB PANELS, 3/16-5052-H39-0.0015P, 1 INCH DEEP

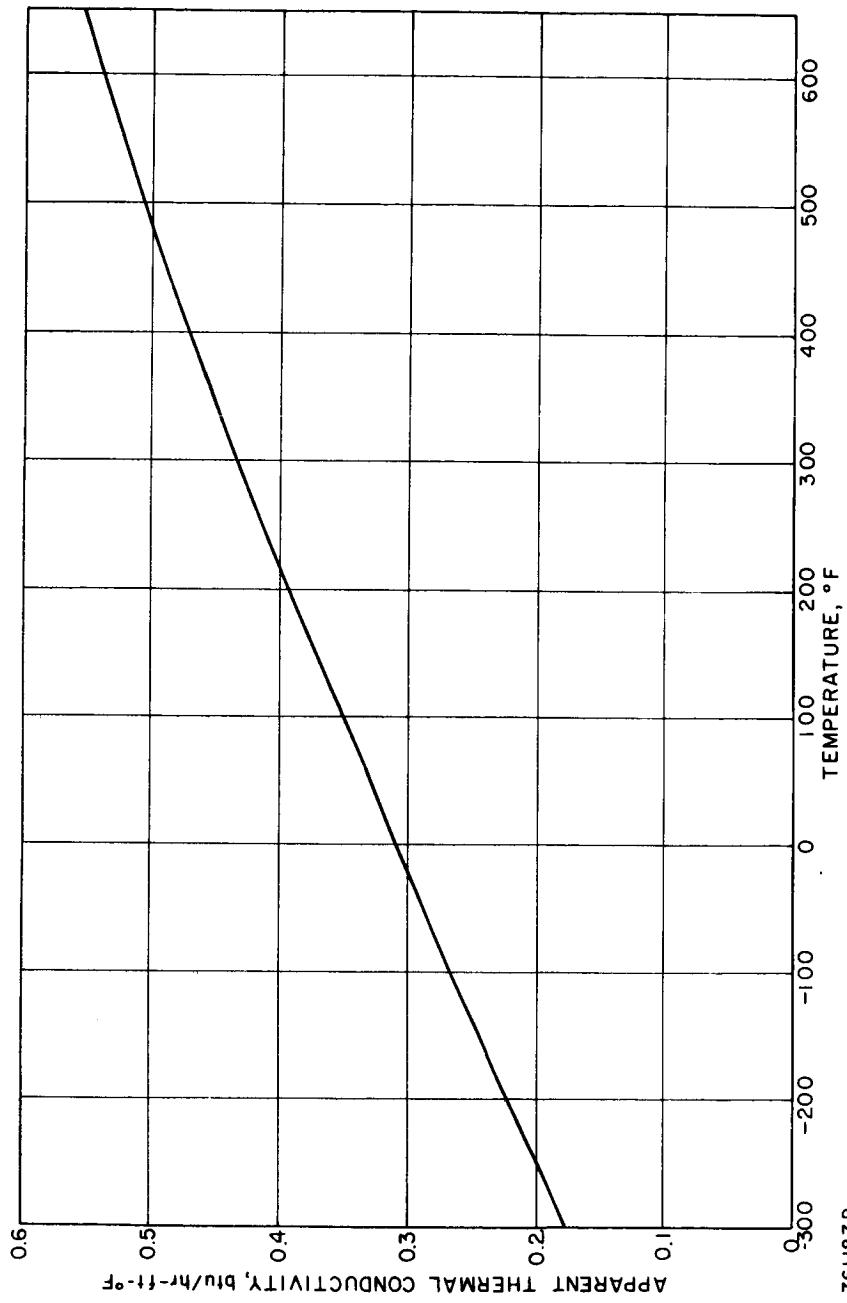


Figure 55 APPARENT THERMAL CONDUCTIVITY OF HT 424 FACE PLATE BOND  
ADHESIVE USED ON ALUMINUM HONEYCOMB PANEL, 0.135 wt ON  
BOND LINE AT ATMOSPHERIC PRESSURE,

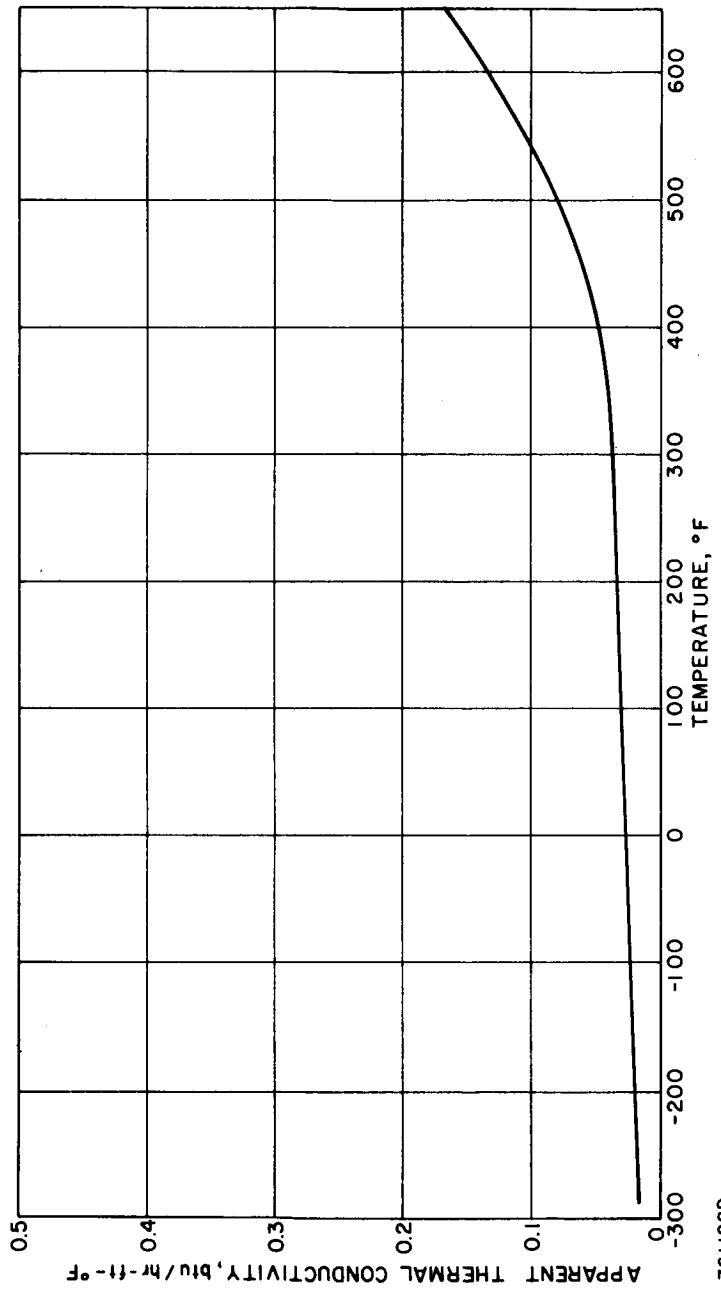


Figure 56 APPARENT THERMAL CONDUCTIVITY OF HT 424 FACE PLATE BOND  
ADHESIVE USED ON ALUMINUM HONEYCOMB PANEL, ATMOSPHERIC  
PRESSURE

761188D

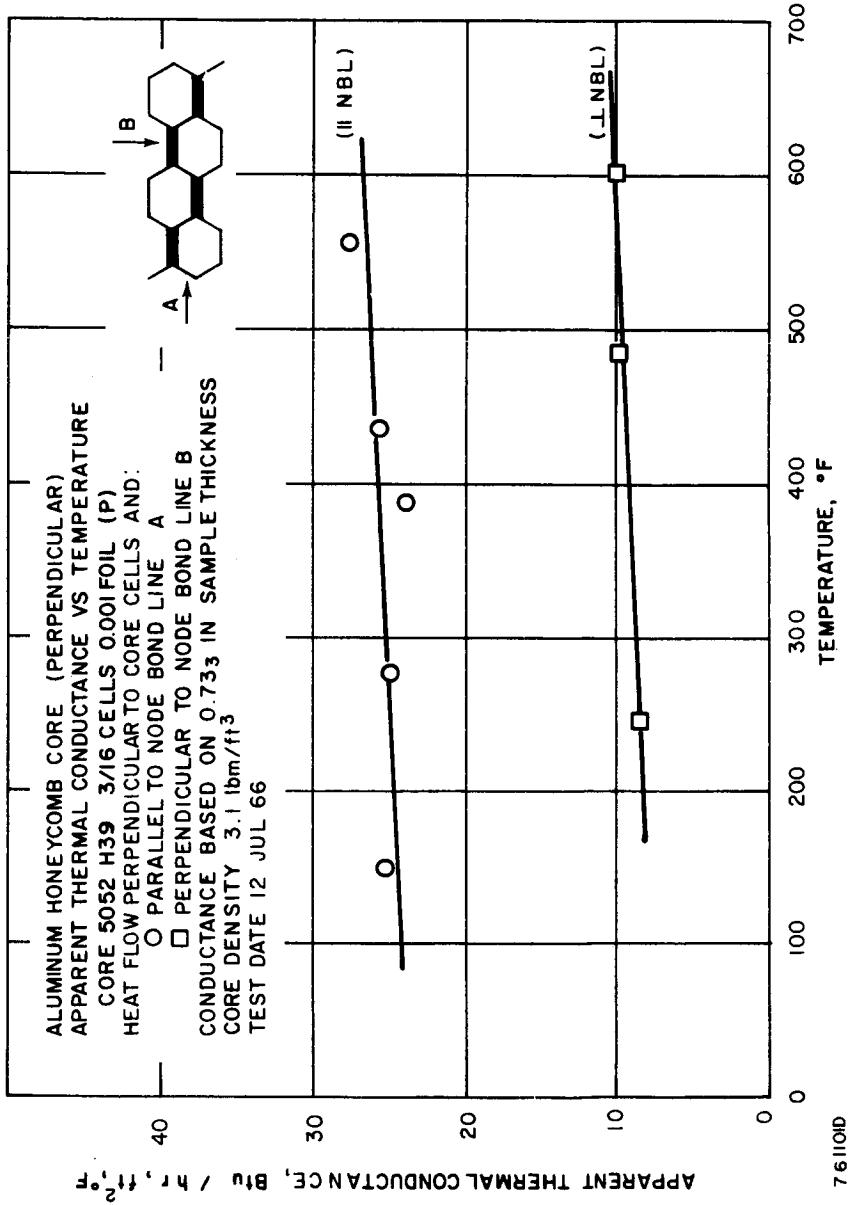


Figure 57 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE,  
 ALUMINUM HONEYCOMB CORE, PARALLEL AND PERPENDICULAR  
 TO NODE BOND LINE

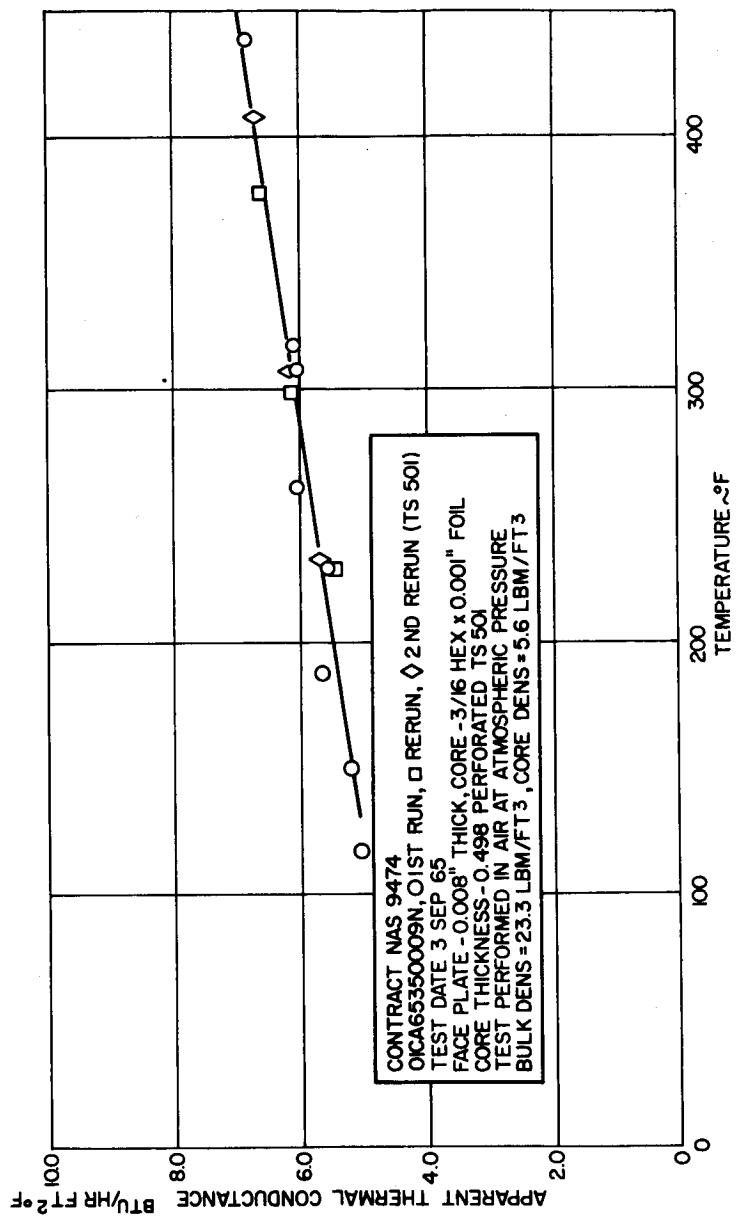


Figure 58 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, STAINLESS STEEL HONEYCOMB PANELS, 3/16-0.001P, 1/2-INCH DEEP (TS 501)

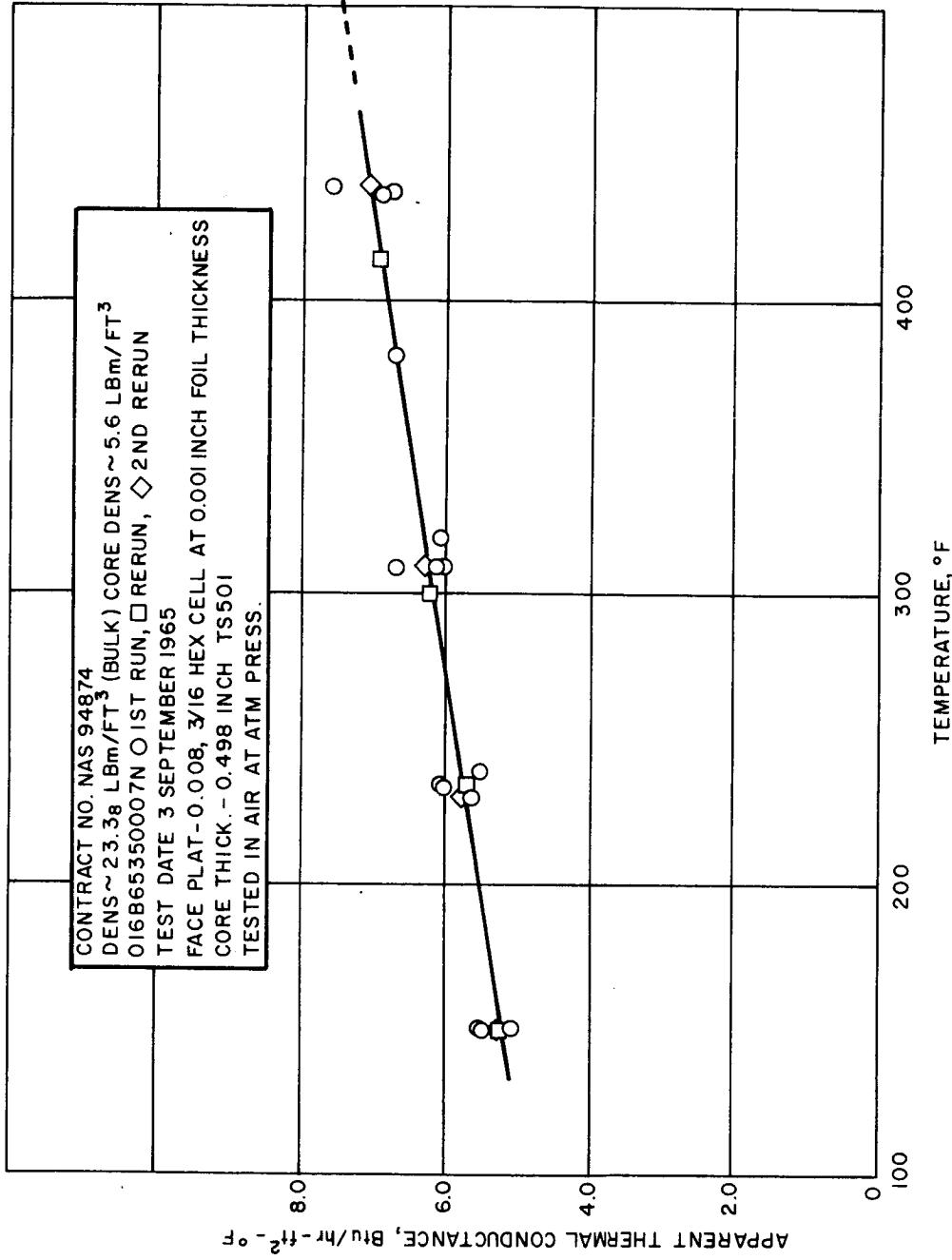


Figure 59 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, STAINLESS STEEL HONEYCOMB PANELS, 3/16-0.001P, 1/2-INCH DEEP (ITS 501)

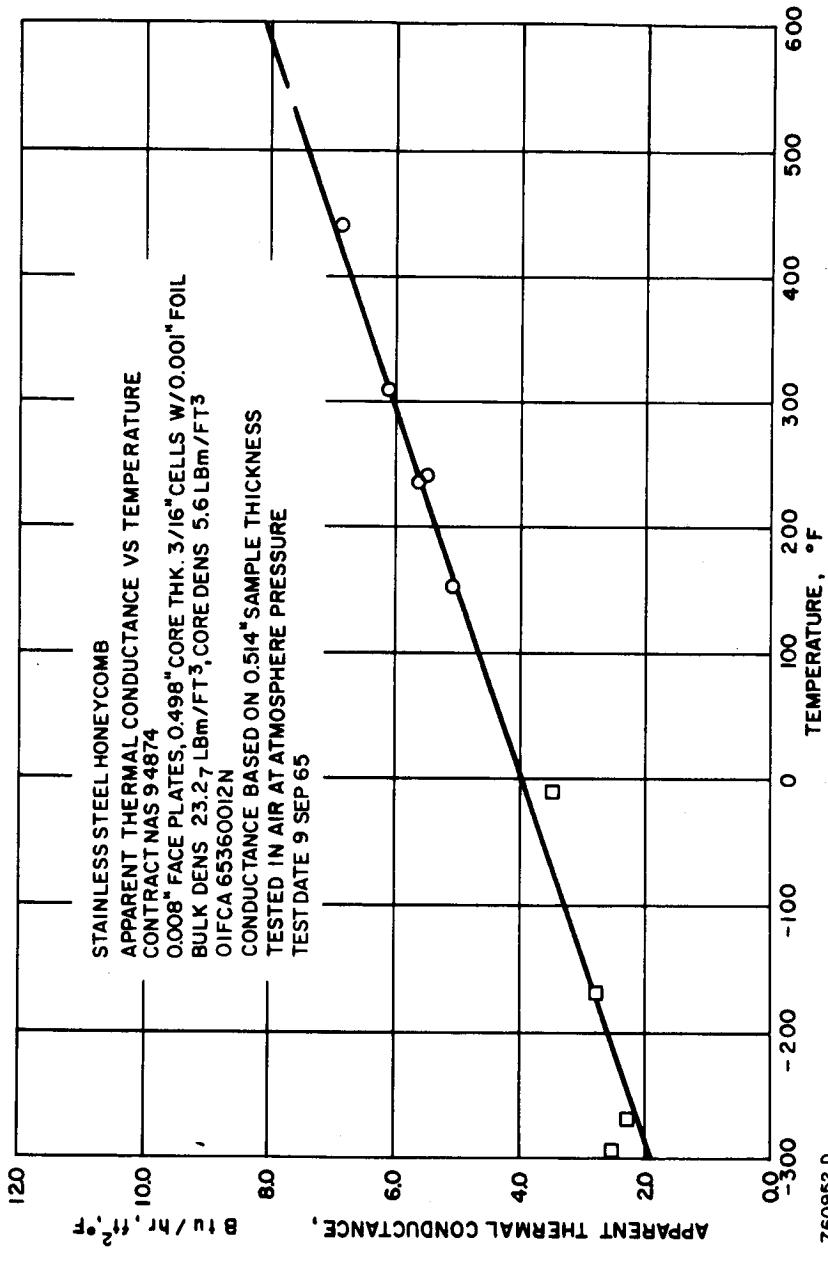


Figure 60 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, STAINLESS STEEL-HONEYCOMB PANELS, 3/16-0.001P, 1/2-INCH DEEP (TS 501)

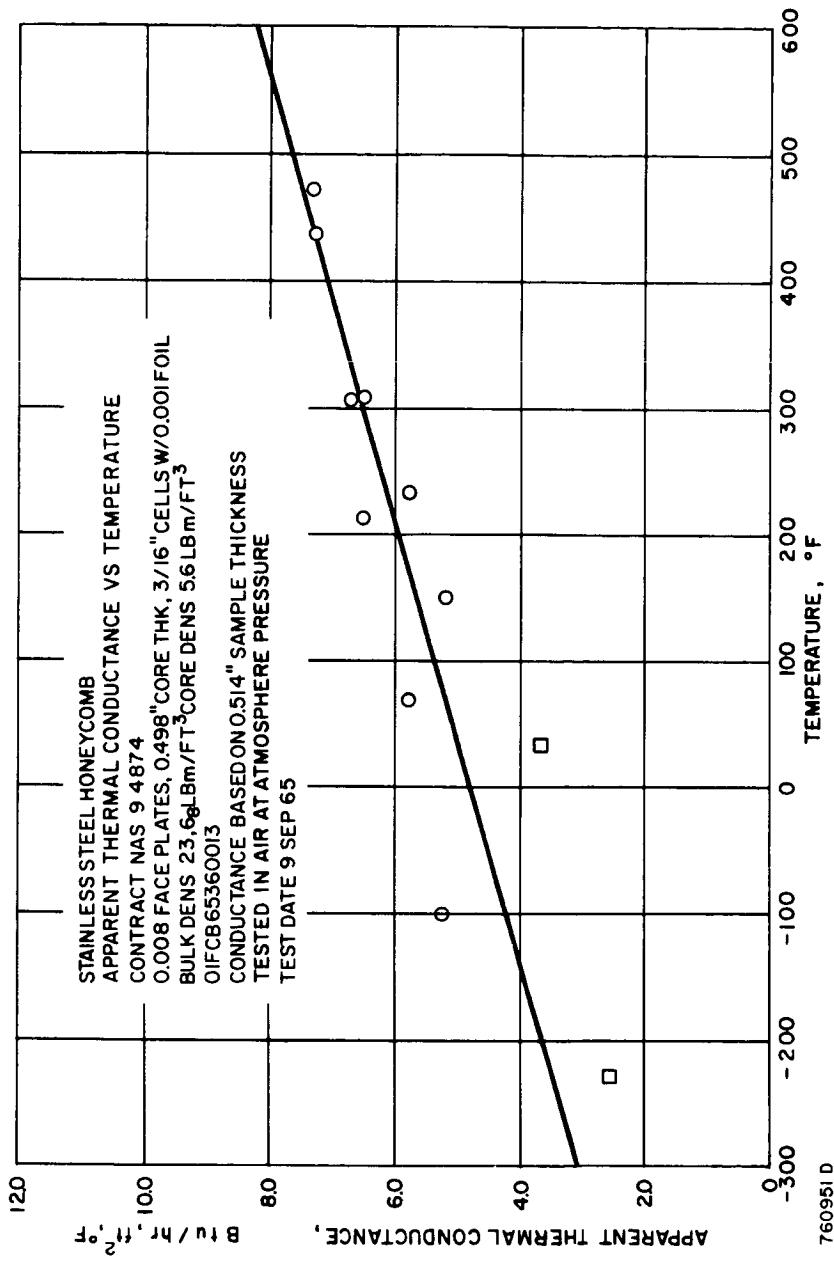


Figure 61 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, STAINLESS STEEL HONEYCOMB PANELS, 3/16-0.001P, 1/2-INCH DEEP (TS 513)

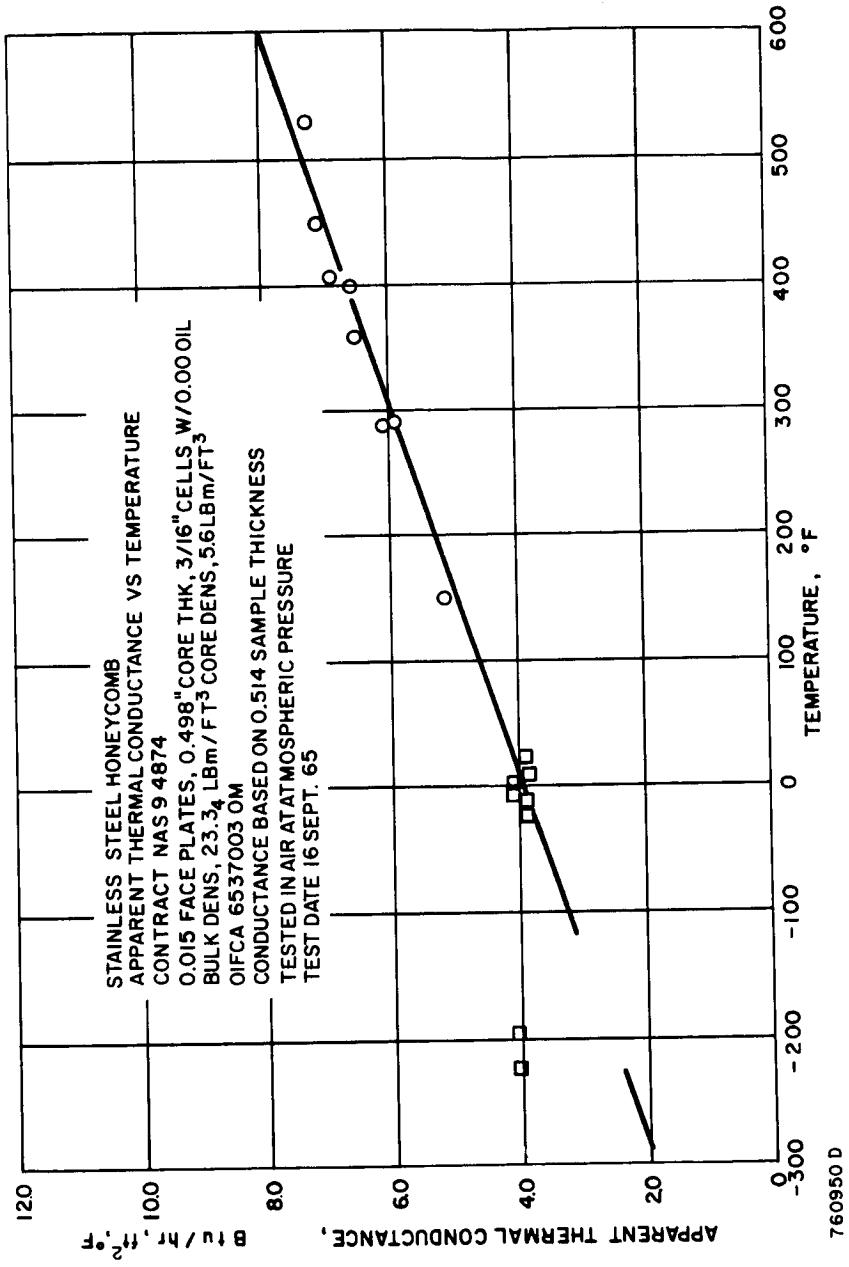


Figure 62 APPARENT THERMAL CONDUCTANCE VERSUS TEMPERATURE, STAINLESS  
STEEL HONEYCOMB PANELS, 3/16.001P, 1/2-INCH DEEP (TS 513)

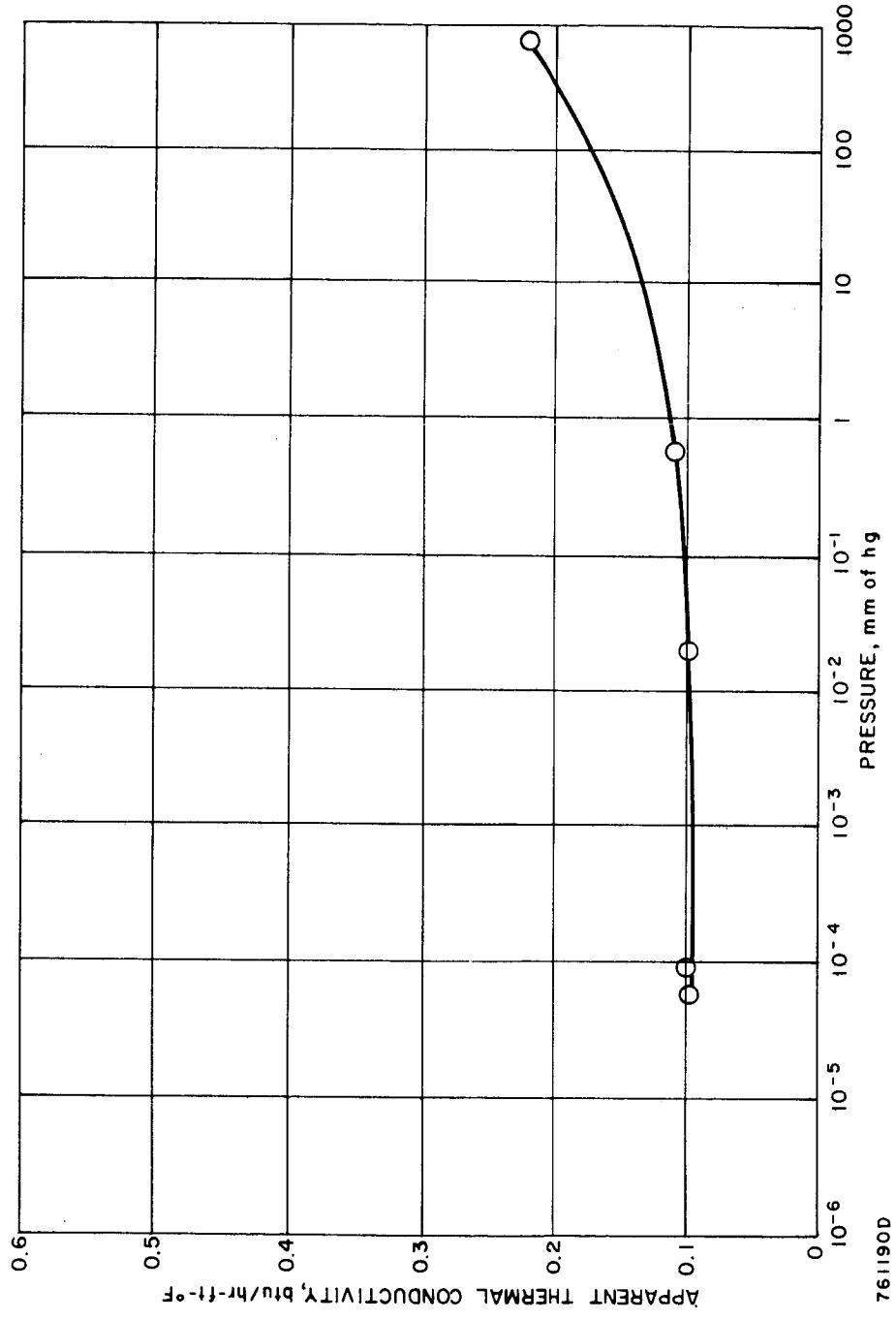


Figure 63 APPARENT THERMAL CONDUCTIVITY VERSUS PRESSURE, STAINLESS STEEL  
HONEYCOMB PANEL, 3/16-0.001P, 1 2-INCH DEEP

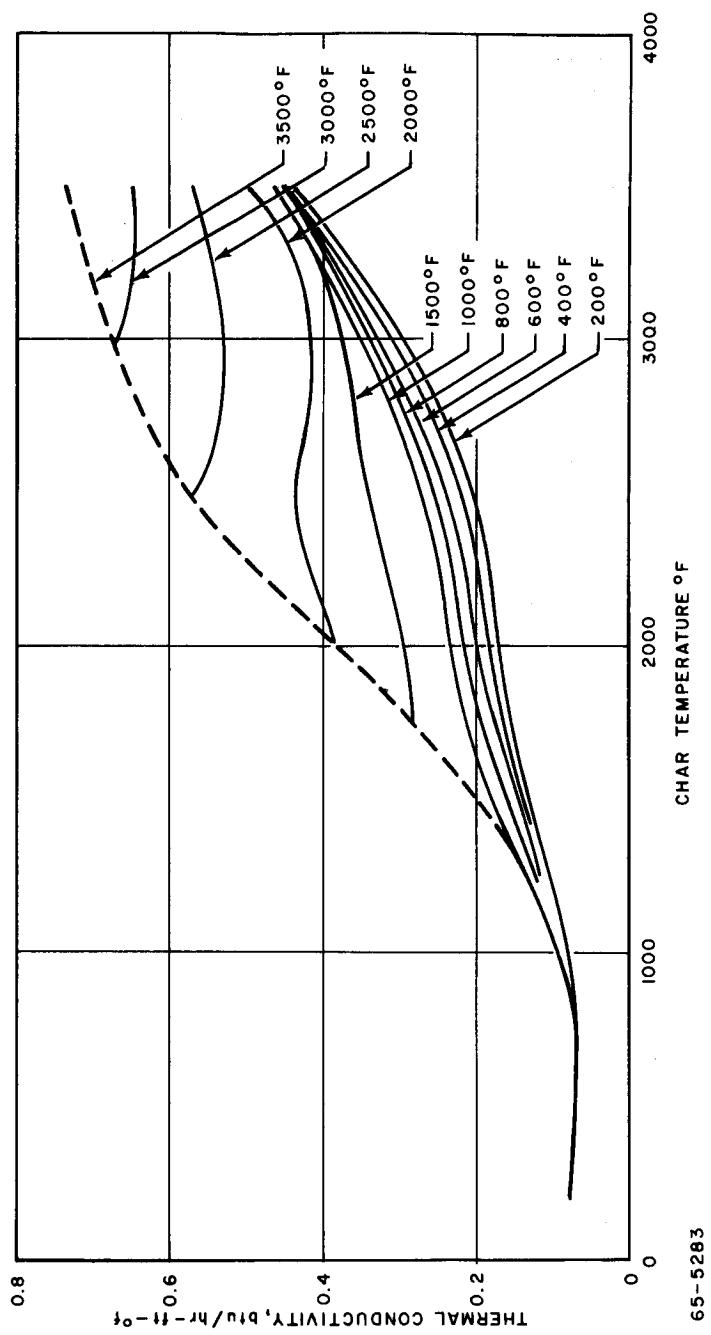


Figure 64 THERMAL CONDUCTIVITY VERSUS CHAR TEMPERATURE OF  
ABLATOR AVCOAT 5026-39

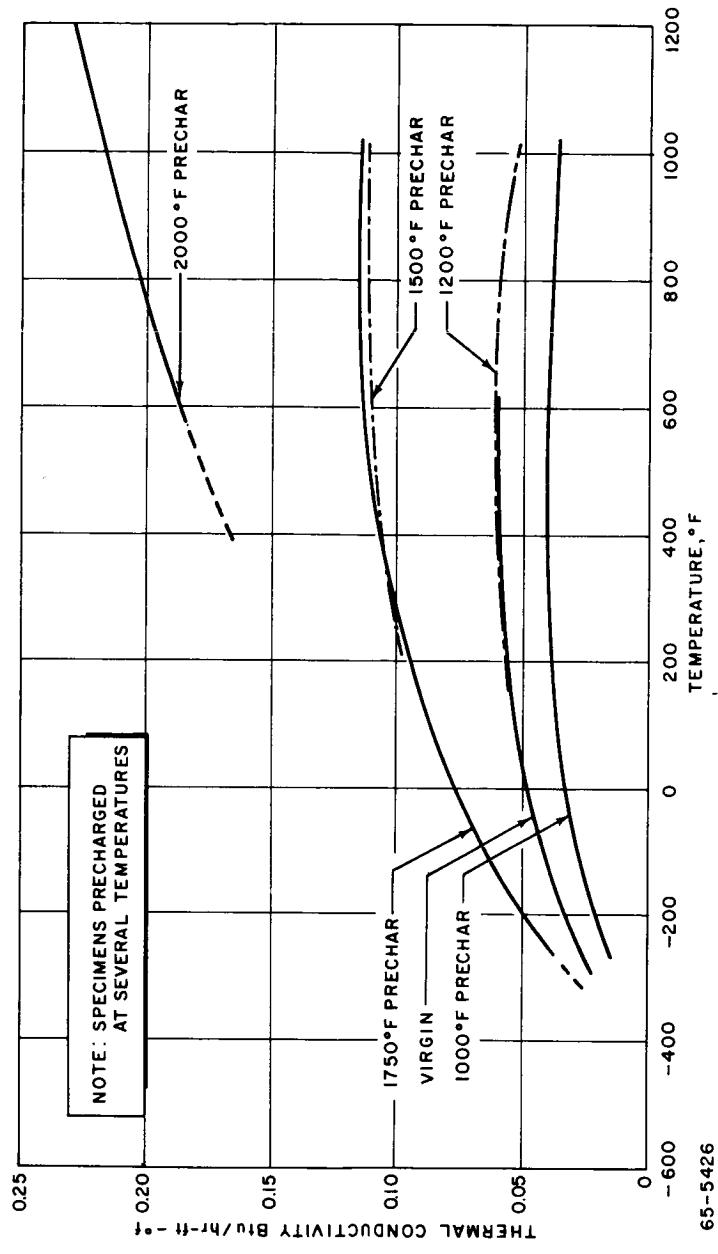


Figure 65 THERMAL CONDUCTIVITY OF CHARRED AVCOAT 5026-39.

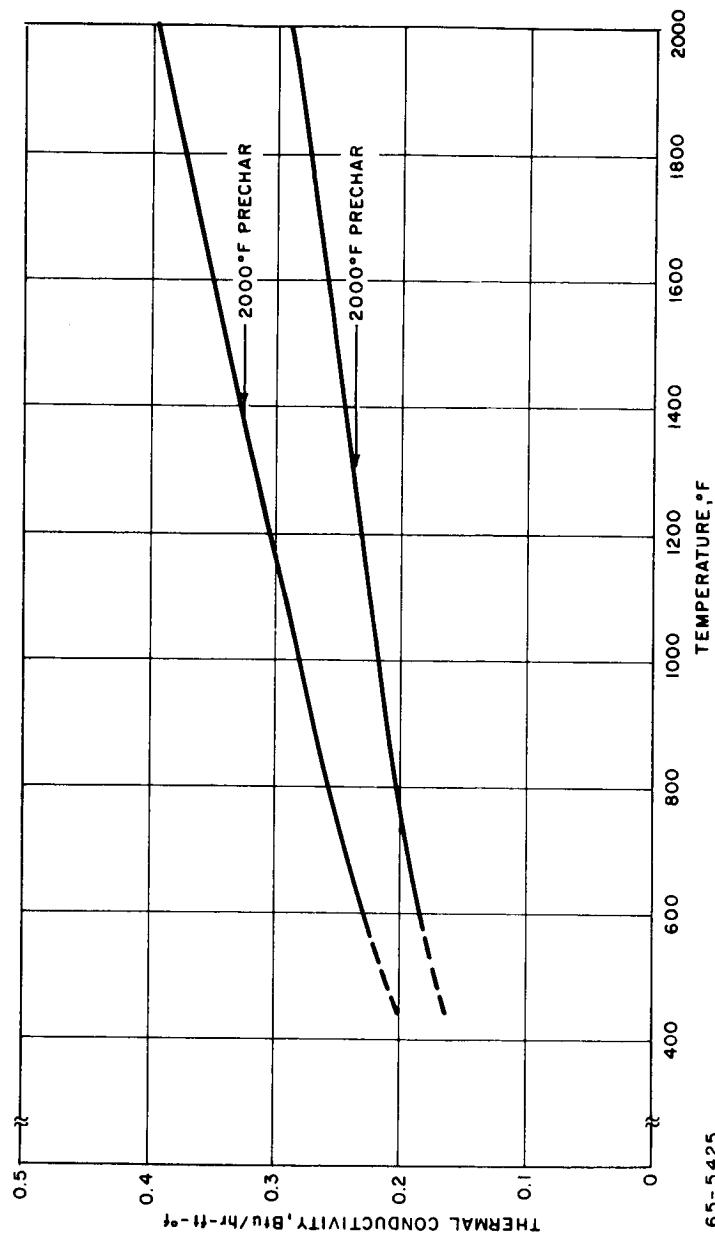


Figure 66 THERMAL CONDUCTIVITY OF CHARRED AVCOAT 5026-39.

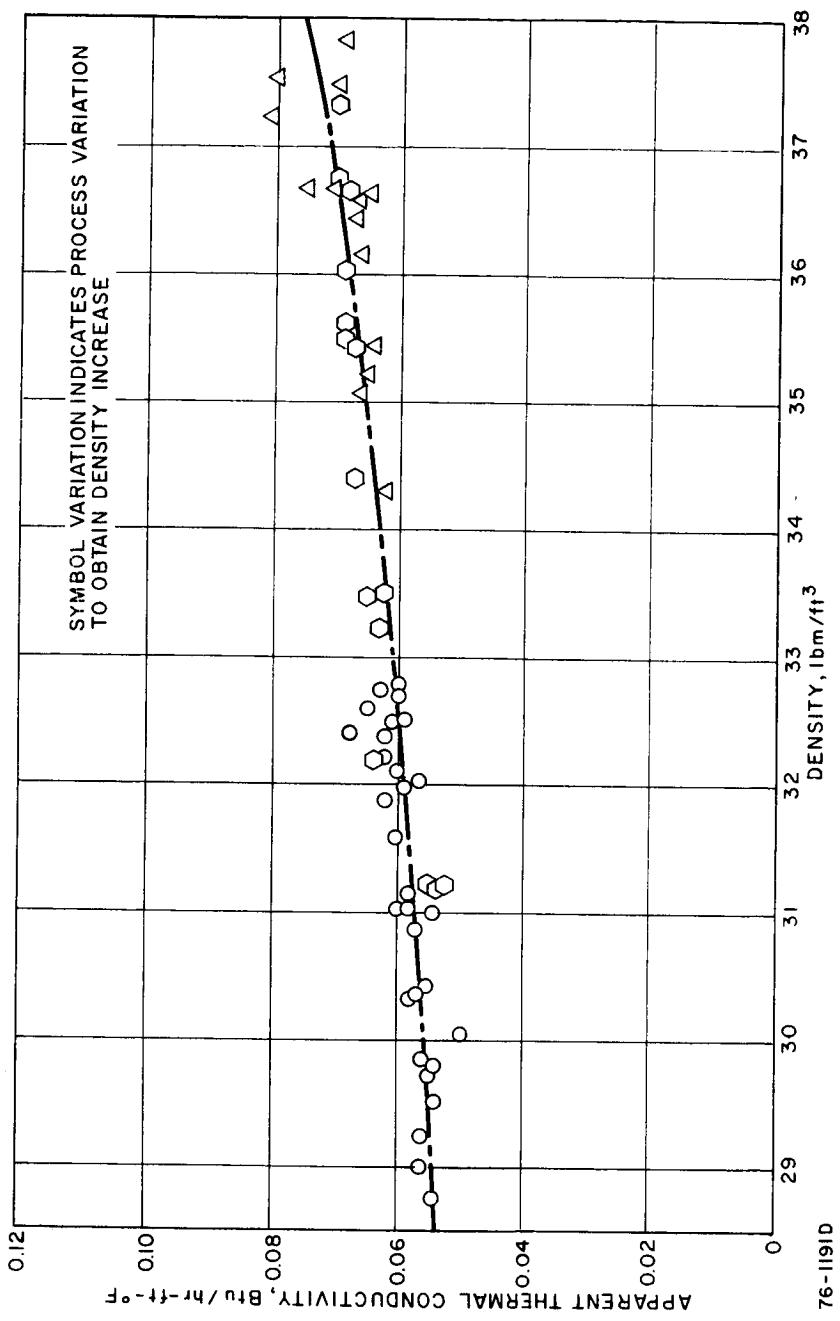


Figure 57 APPARENT THERMAL CONDUCTIVITY VERSUS DENSITY OF  
ABLATOR, AVCOAT 5026-39

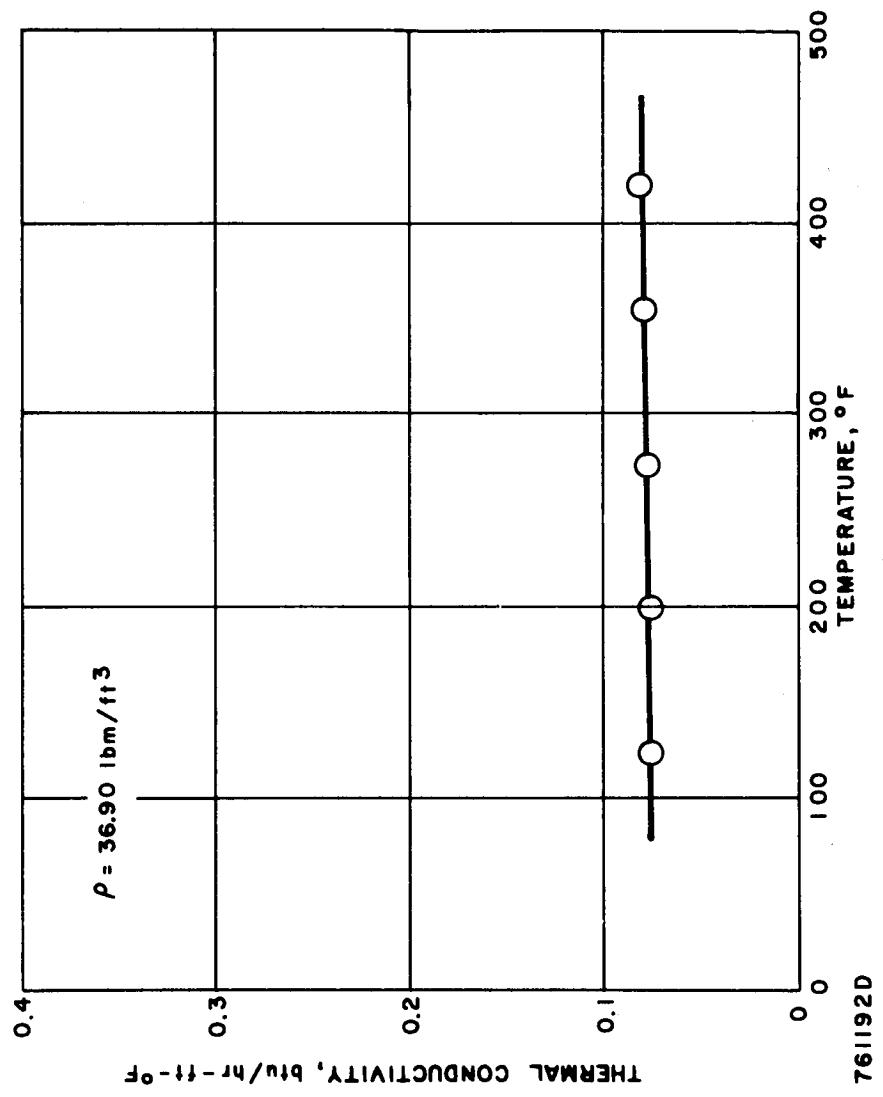


Figure 68 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
NASA PURPLE BLEND

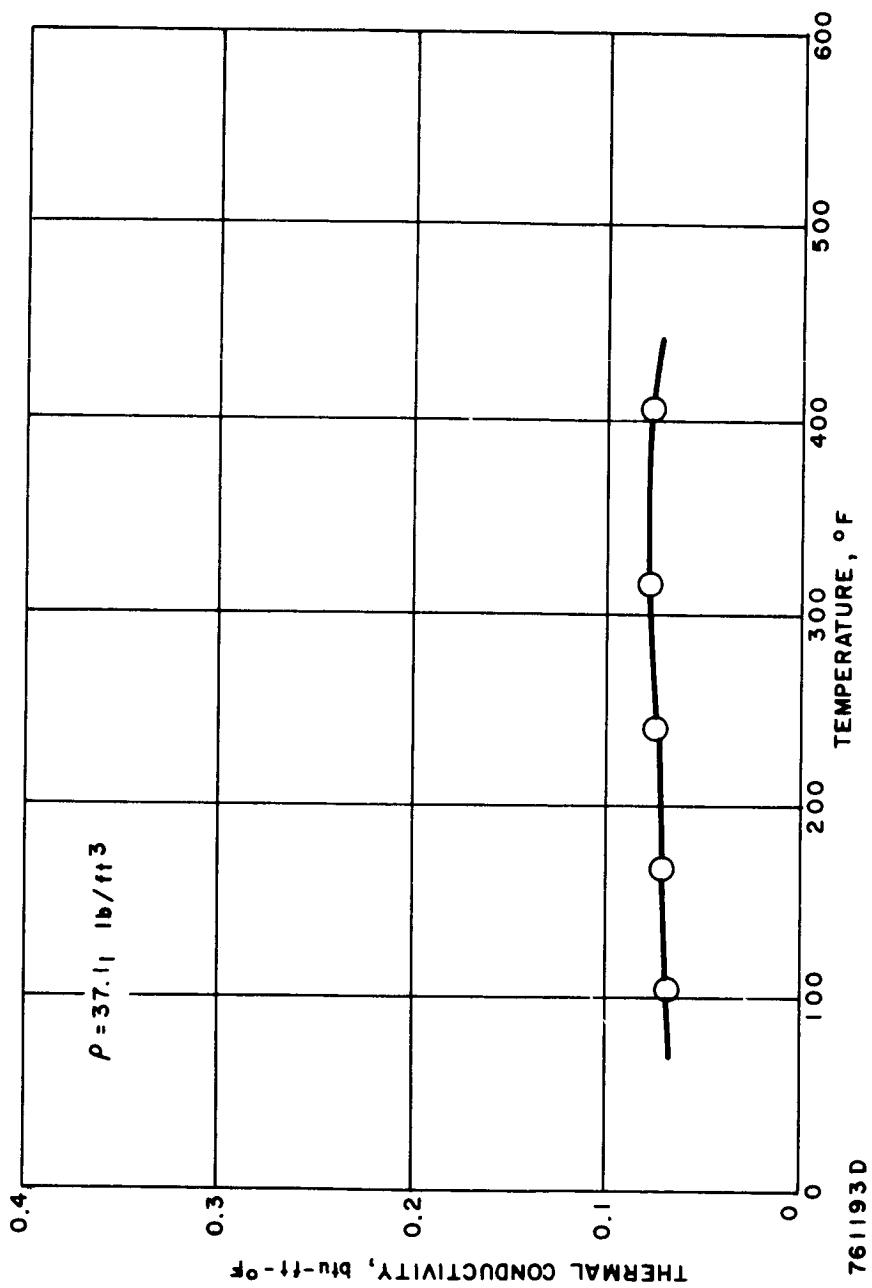


Figure 69 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
NASA PURPLE BLEND

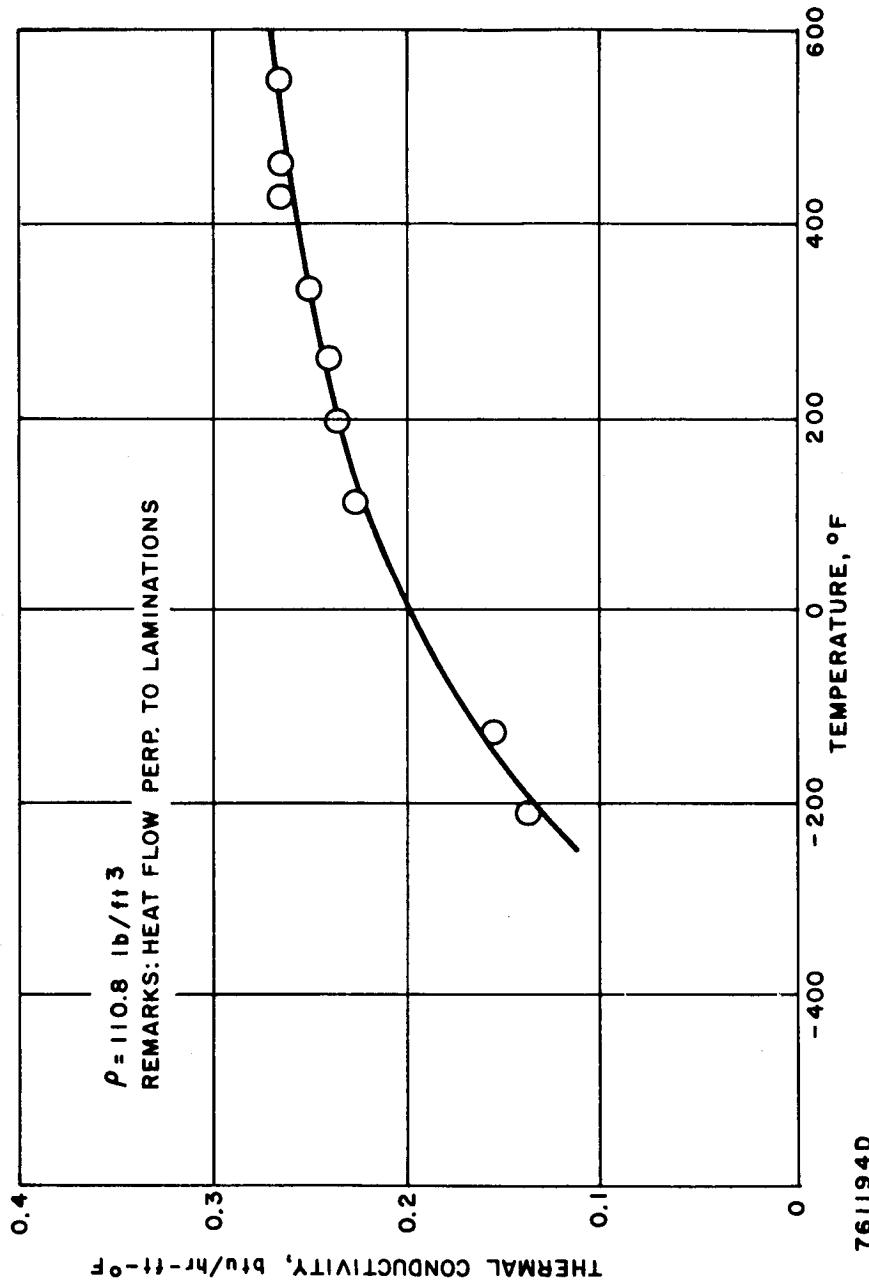


Figure 70 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
EPOXY LAMINATED FIBERGLASS

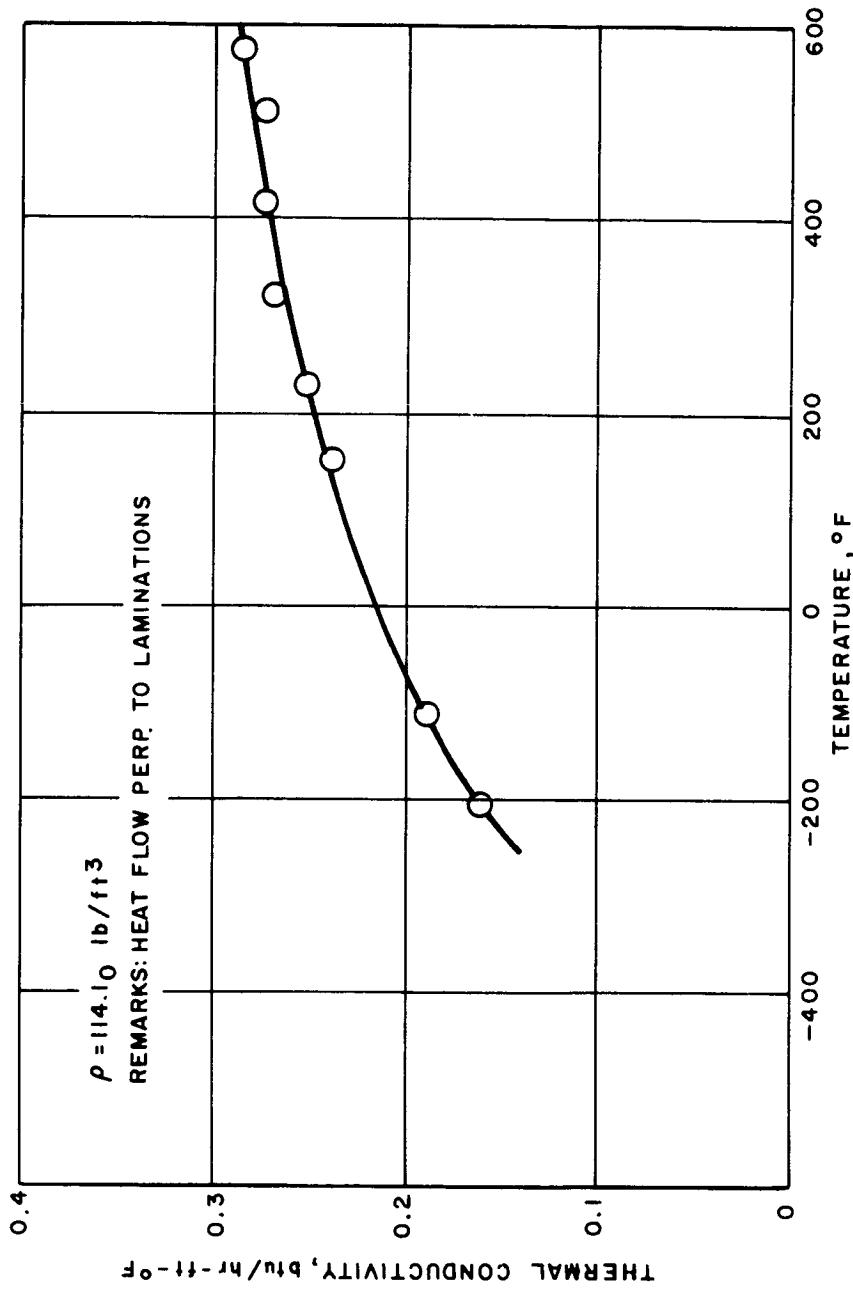


Figure 71 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
EPOXY LAMINATED FIBERGLASS

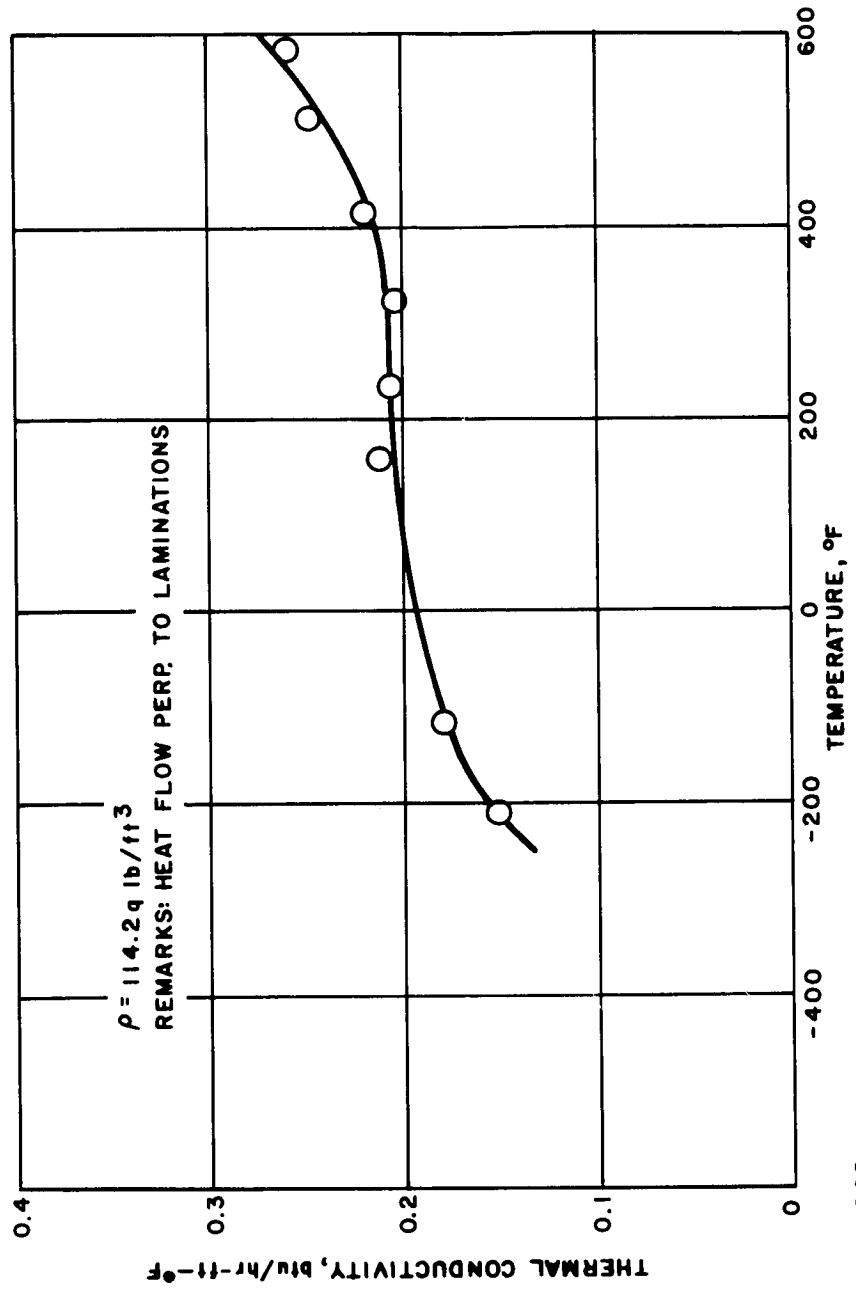


Figure 72 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
EPOXY LAMINATED FIBERGLASS

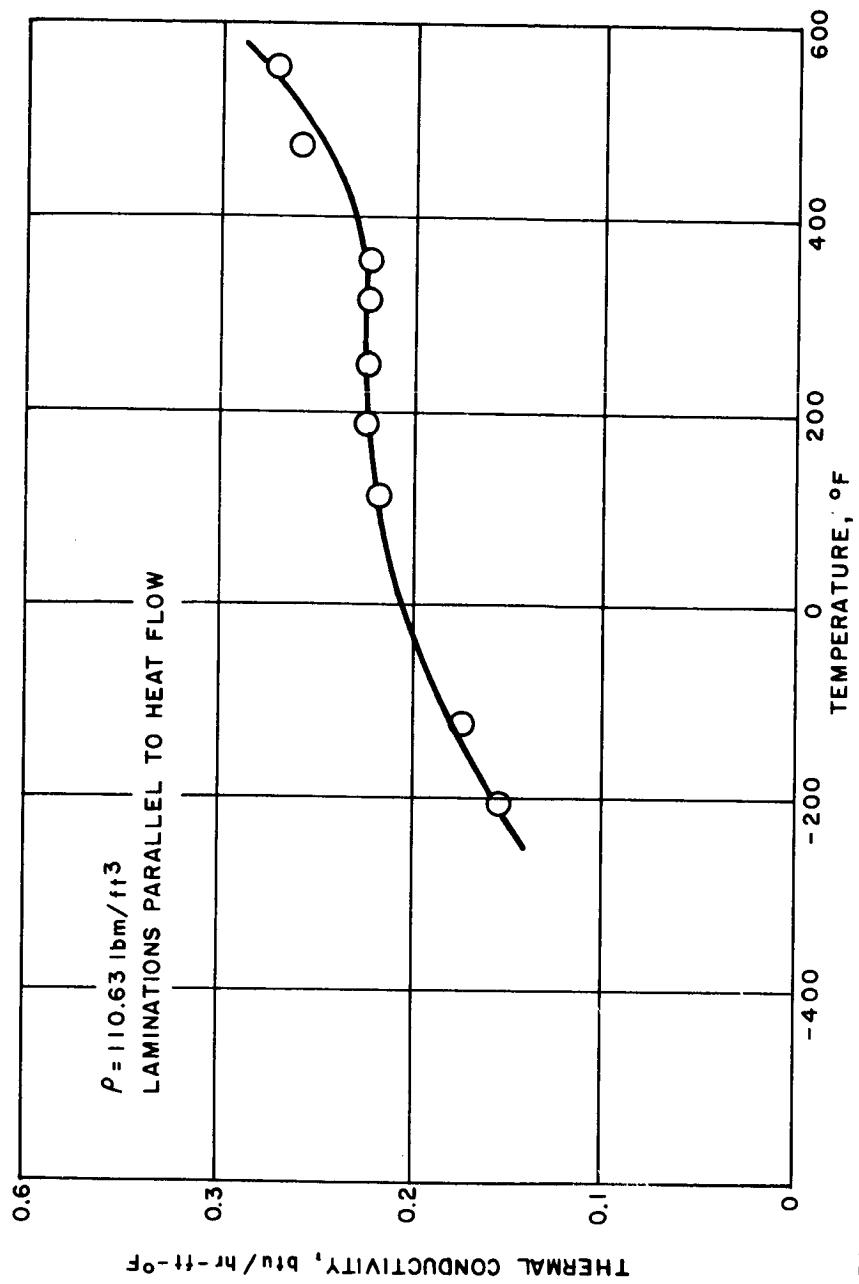


Figure 73 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
EPOXY LAMINATED FIBERGLASS

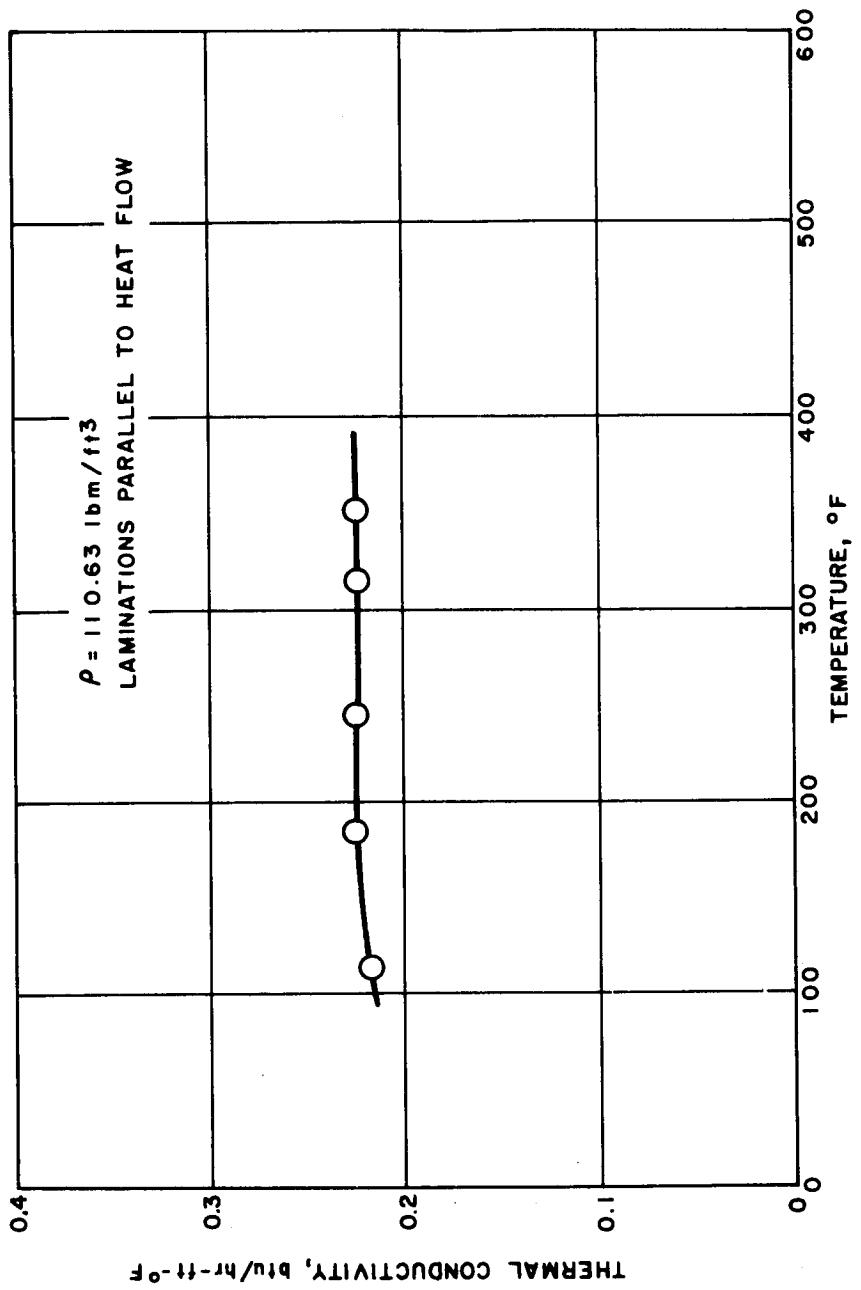


Figure 74 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
EPOXY LAMINATED FIBERGLASS

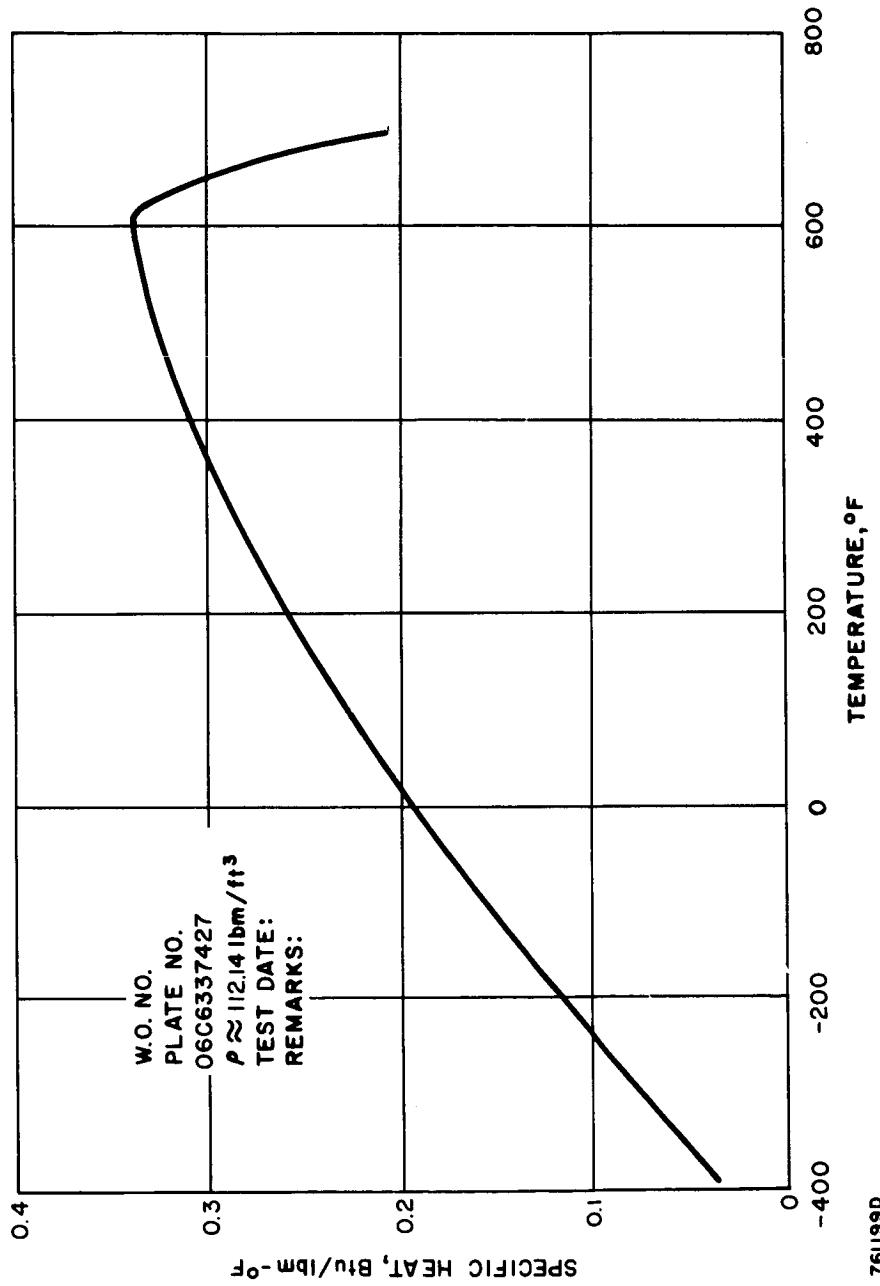


Figure 75 SPECIFIC HEAT VERSUS TEMPERATURE, EPOXY LAMINATED FIBERGLASS

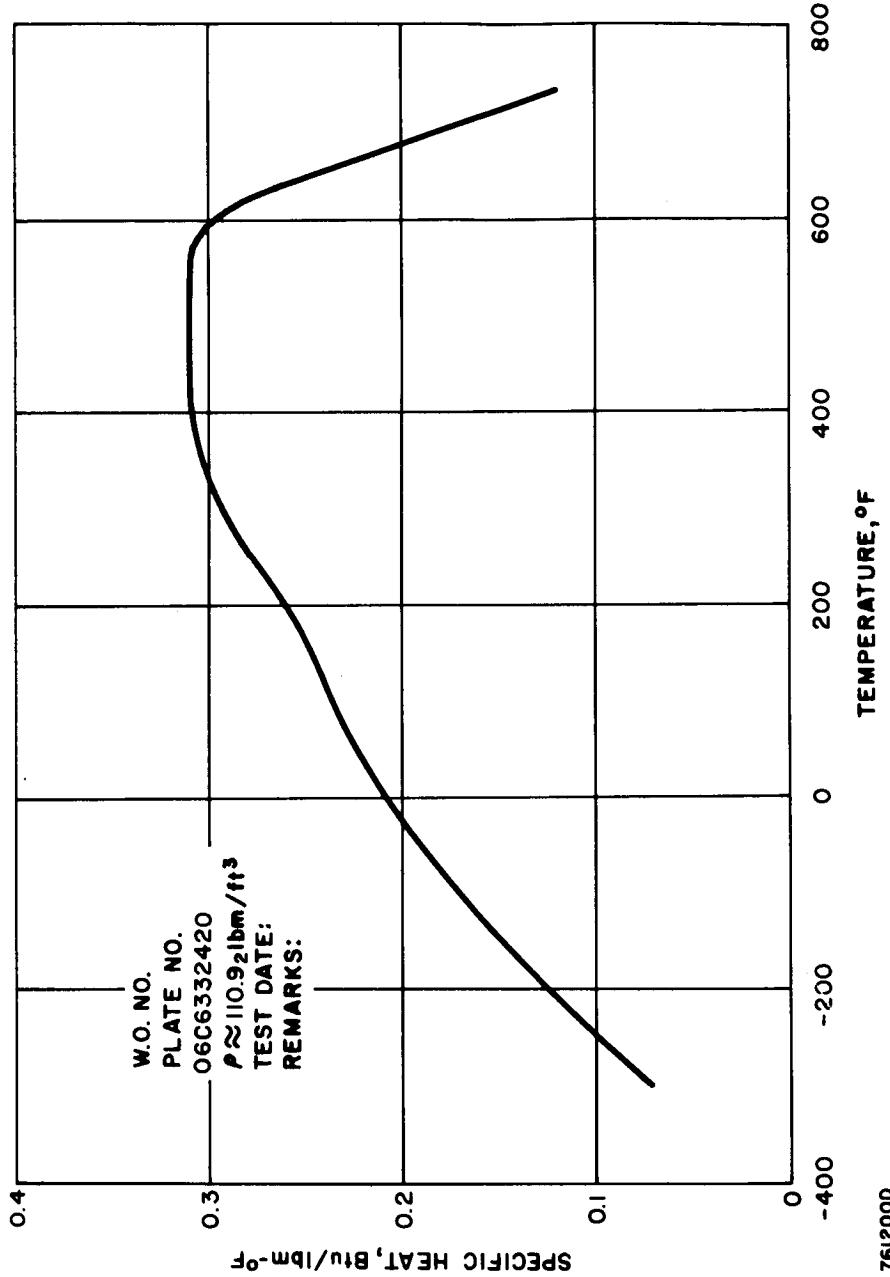


Figure 76 SPECIFIC HEAT VERSUS TEMPERATURE, EPOXY LAMINATED FIBERGLASS

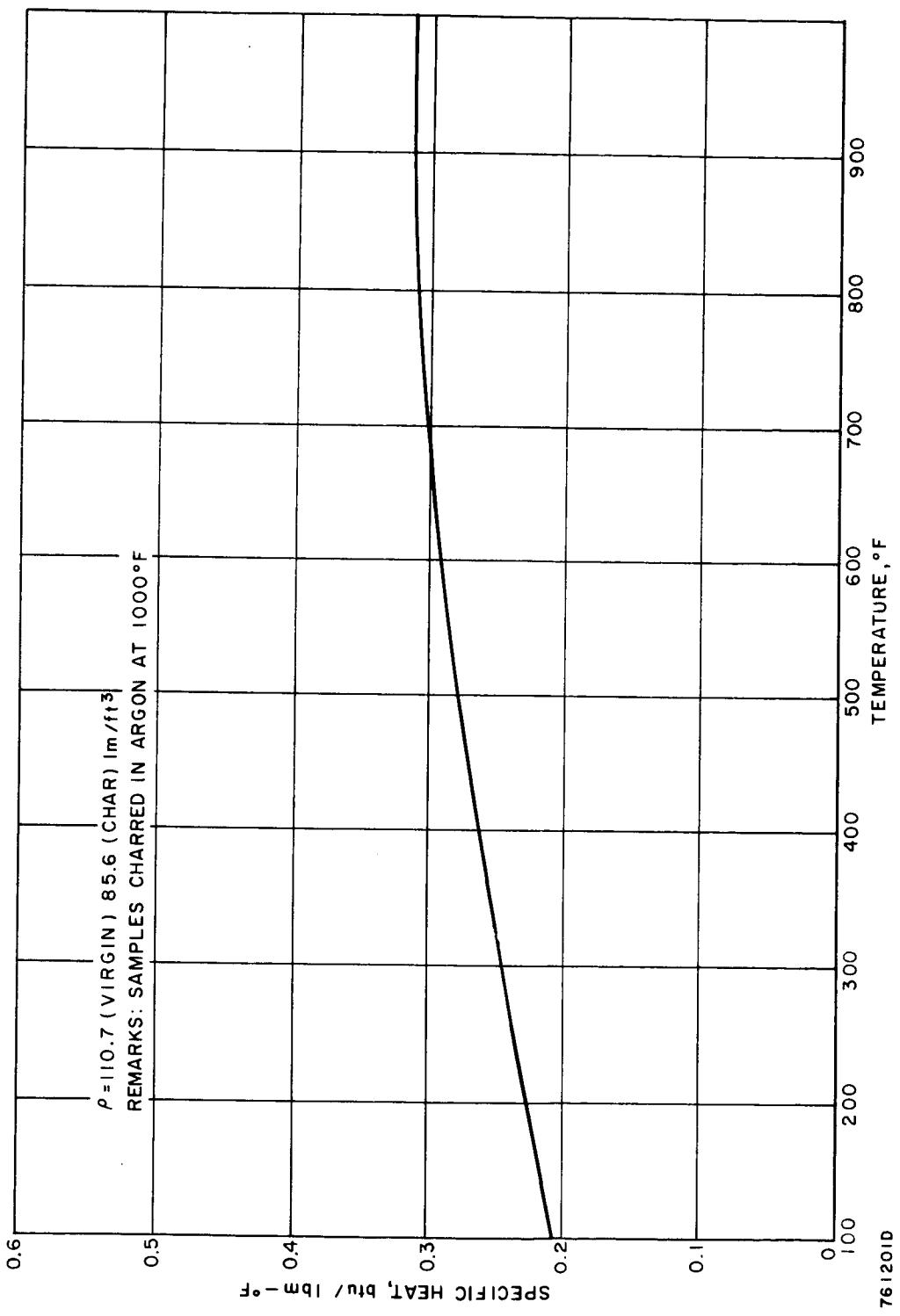
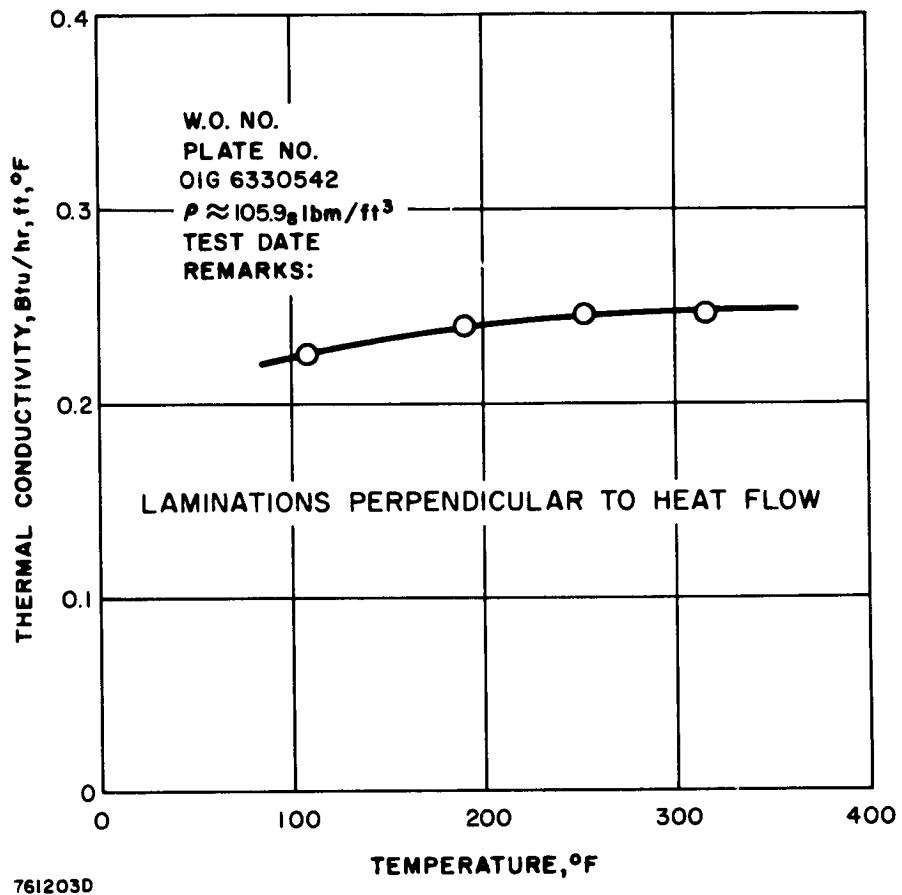


Figure 77 SPECIFIC HEAT VERSUS TEMPERATURE, EPOXY LAMINATED  
FIBERGLASS



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Figure 90 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
PHENOLIC LAMINATED FIBERGLASS

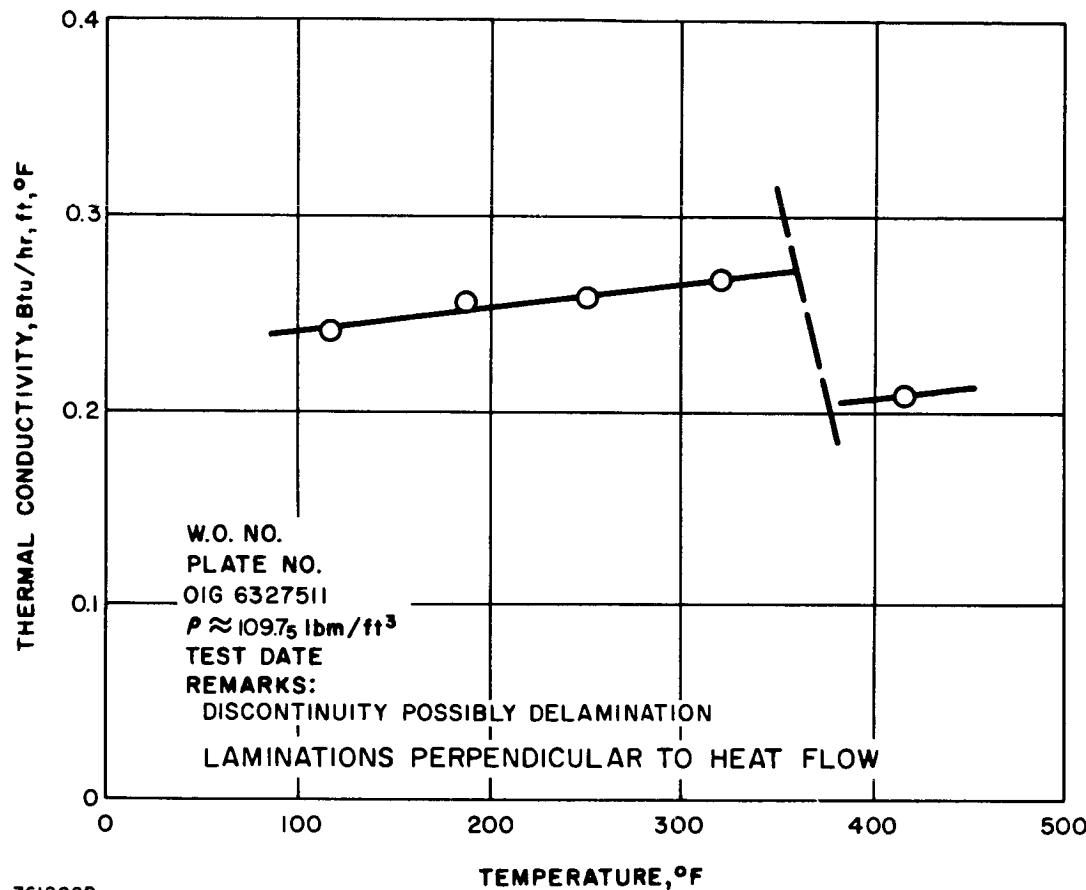


Figure 89 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
PHENOLIC LAMINATED FIBERGLASS

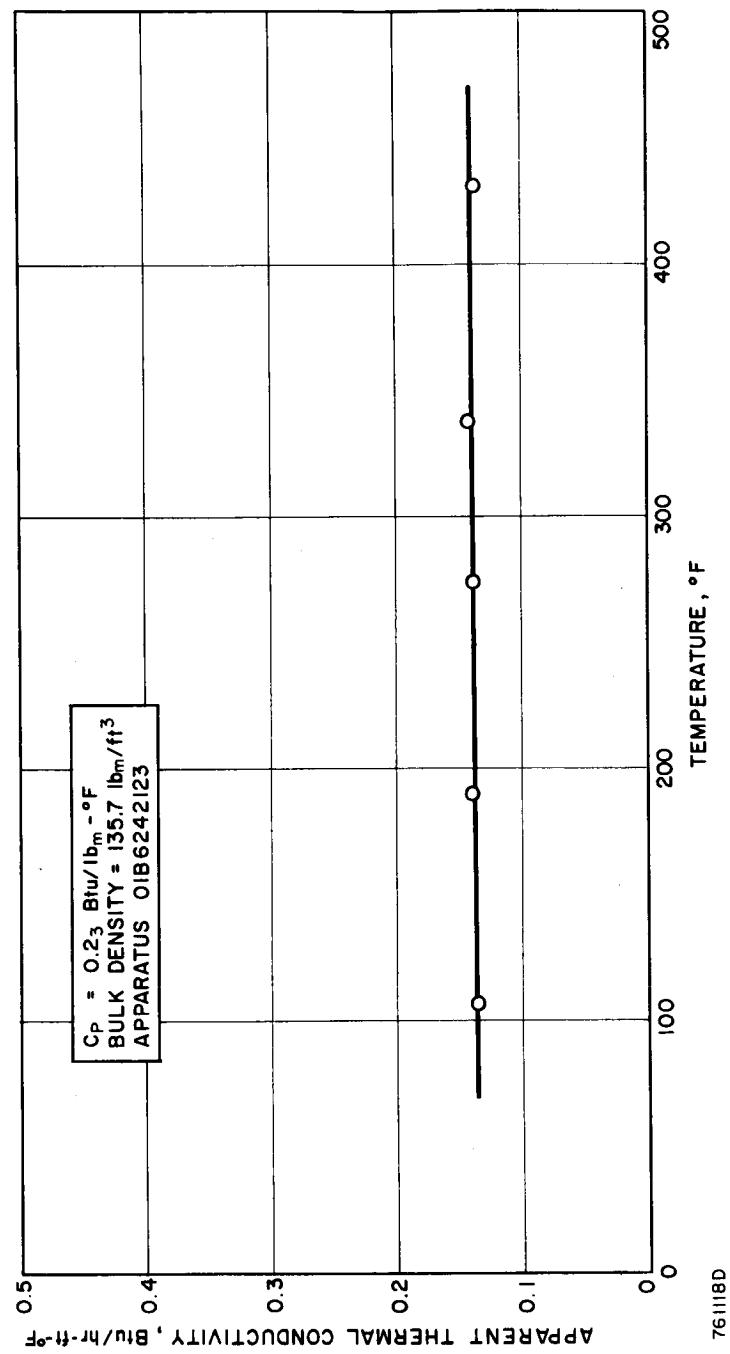


Figure 80 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE, TEFLON

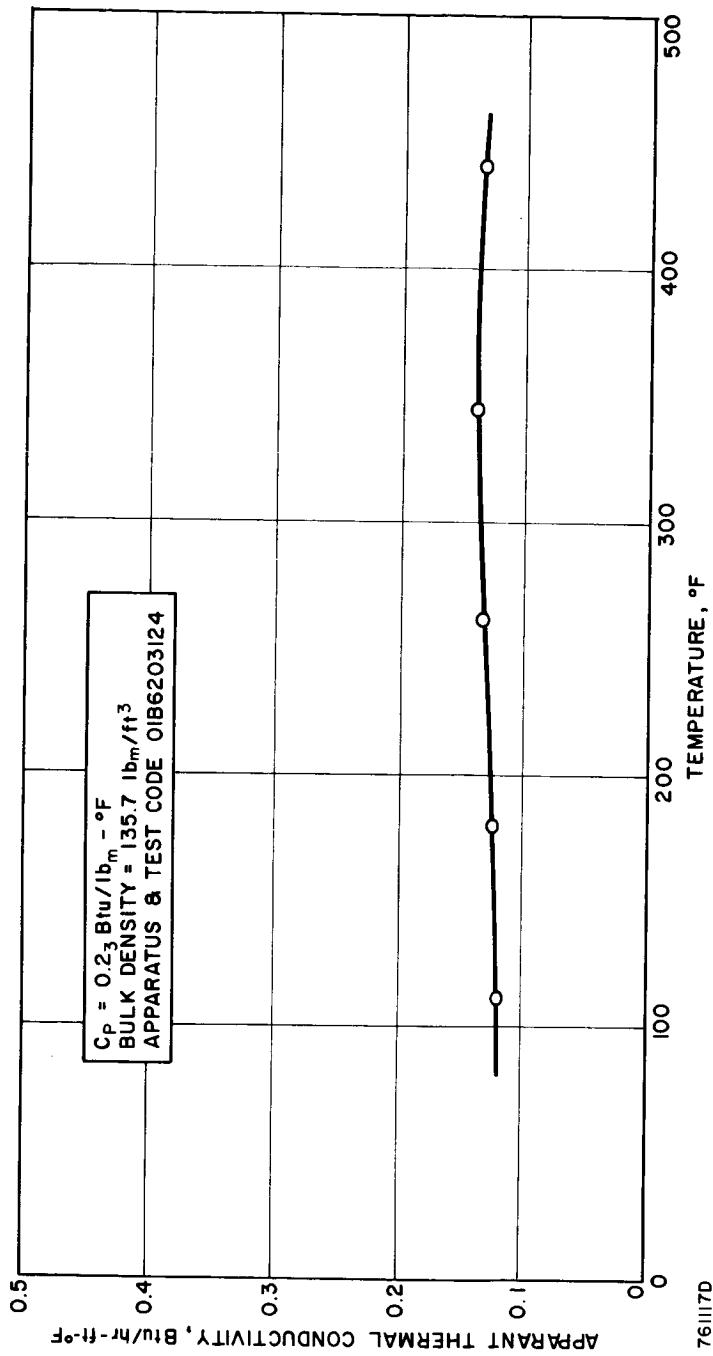


Figure 81 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE, TEFLON

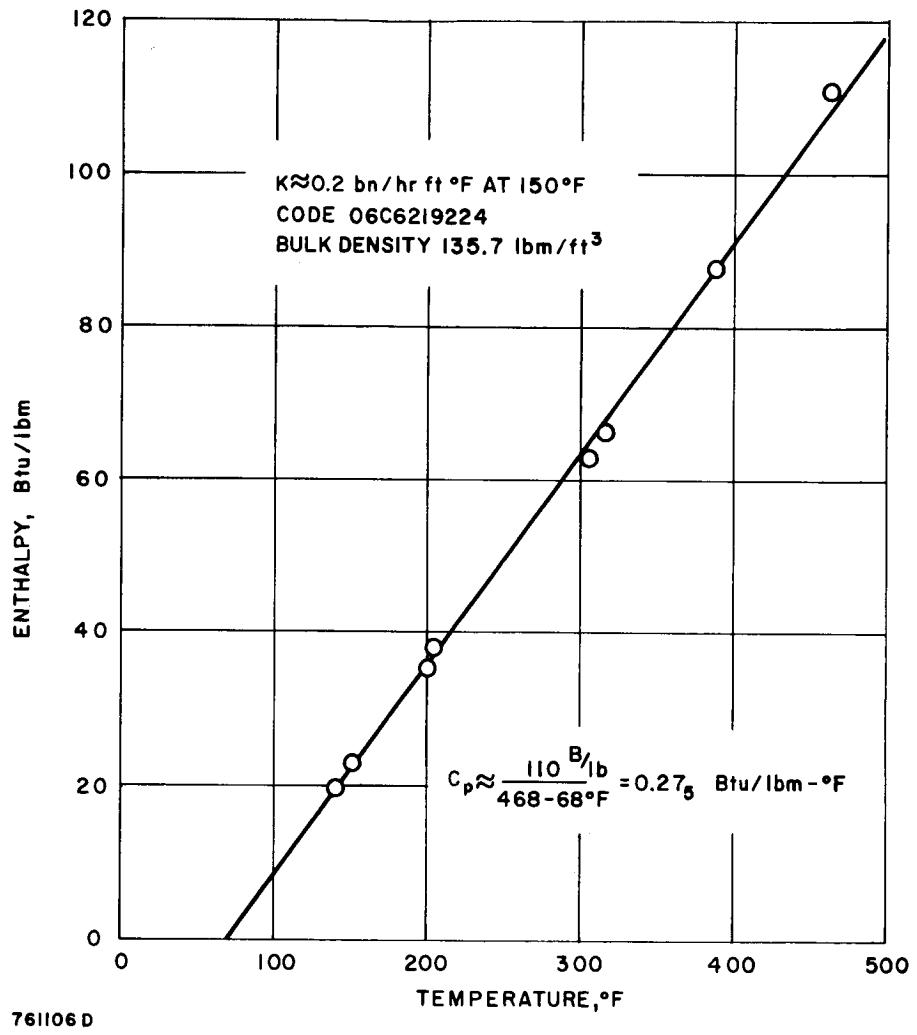


Figure 82 SPECIFIC HEAT VERSUS TEMPERATURE, TEFLON

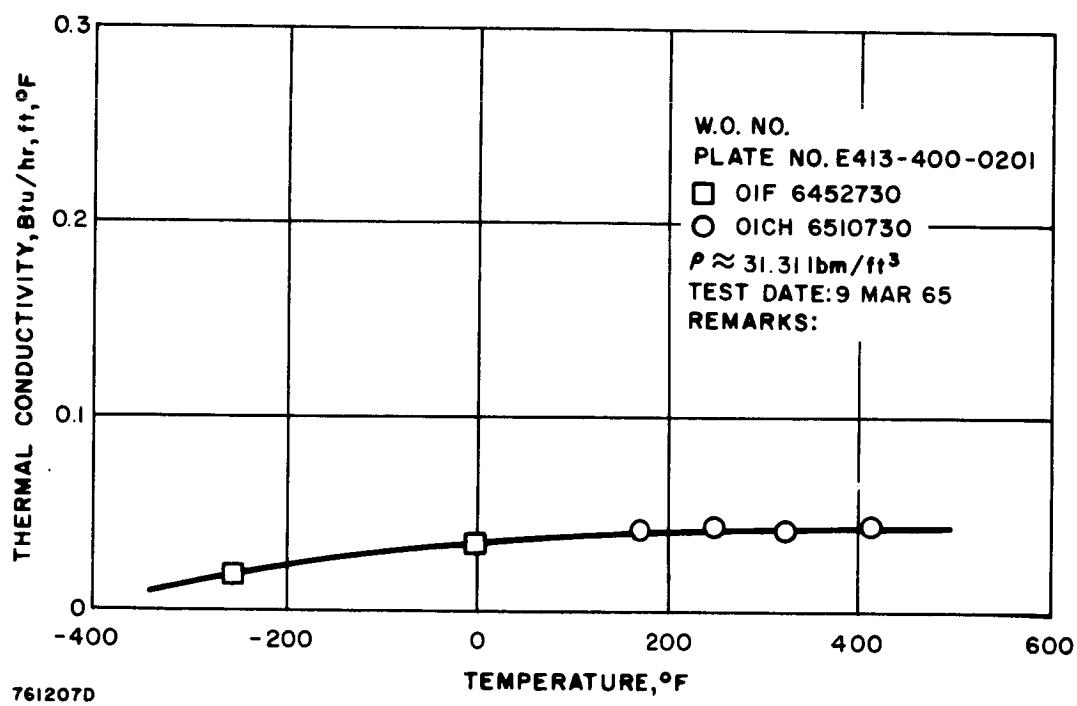


Figure 83 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE, CORK A2755

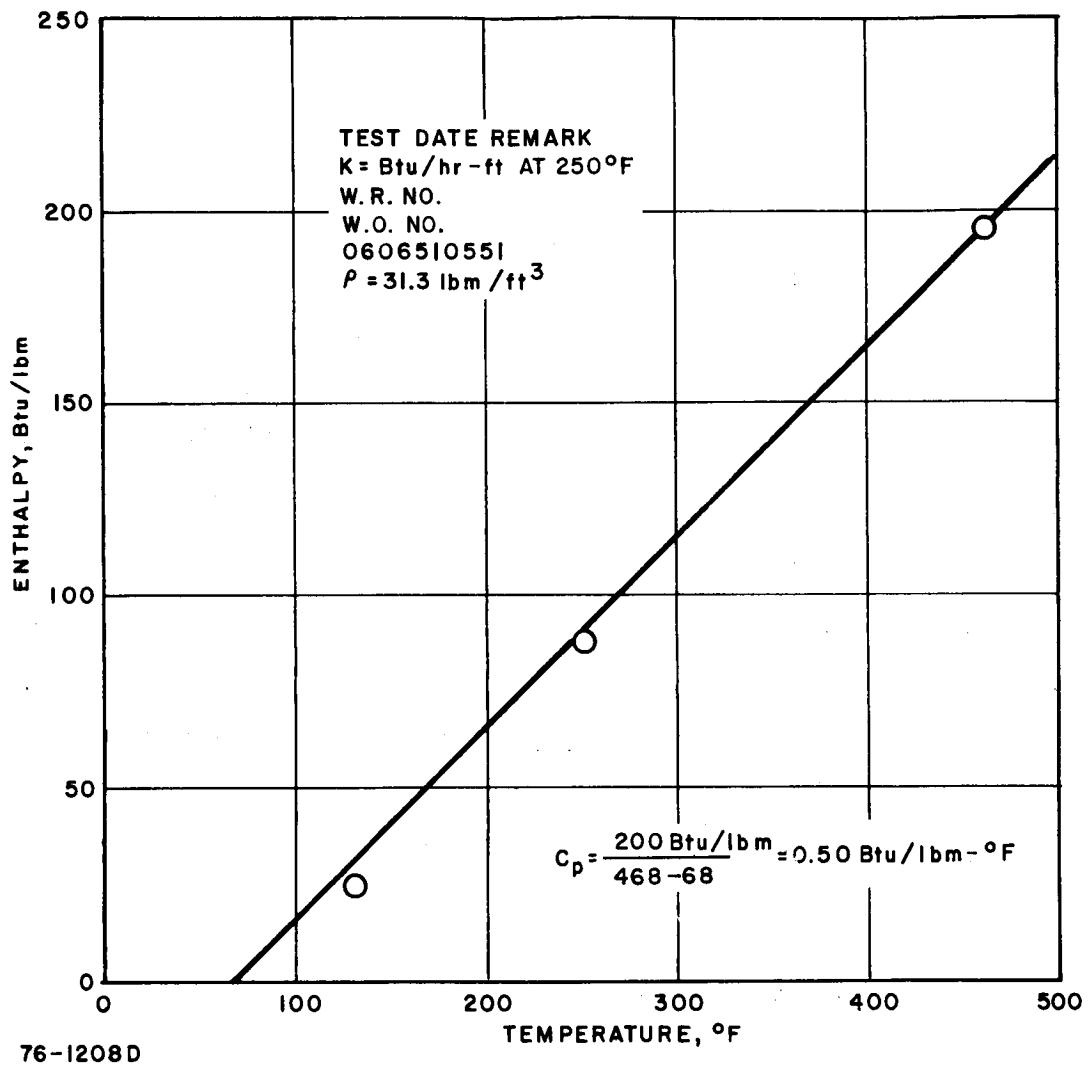


Figure 84 SPECIFIC HEAT VERSUS TEMPERATURE, CORK A2755

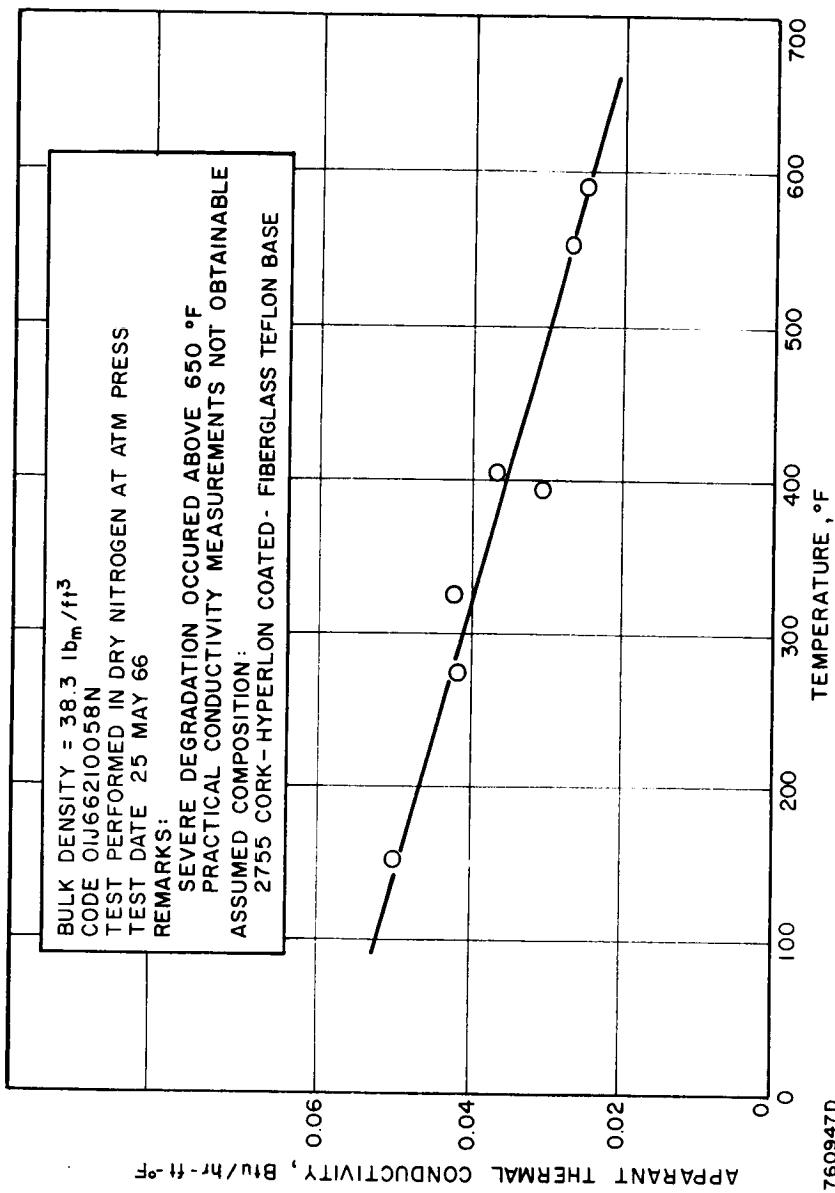


Figure 85 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
BOOST PROTECTIVE COVER OF A2755

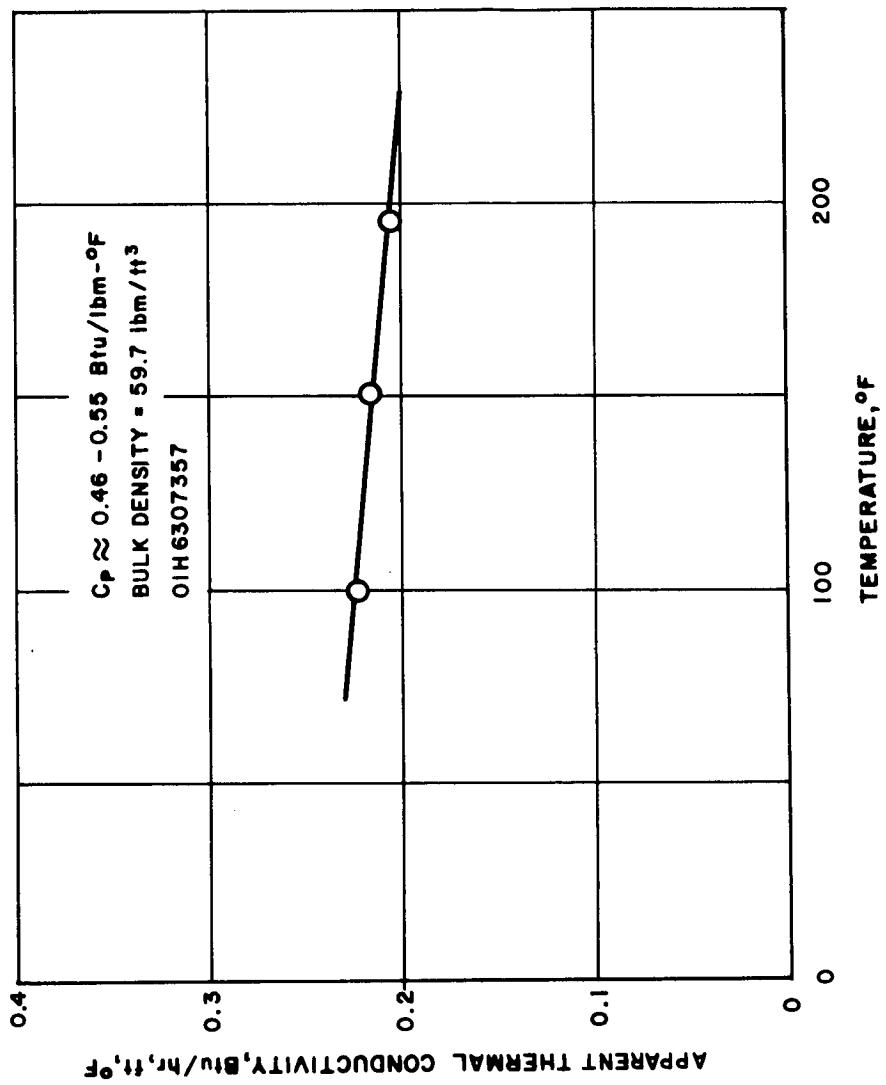


Figure 86 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
POLYETHYLENE

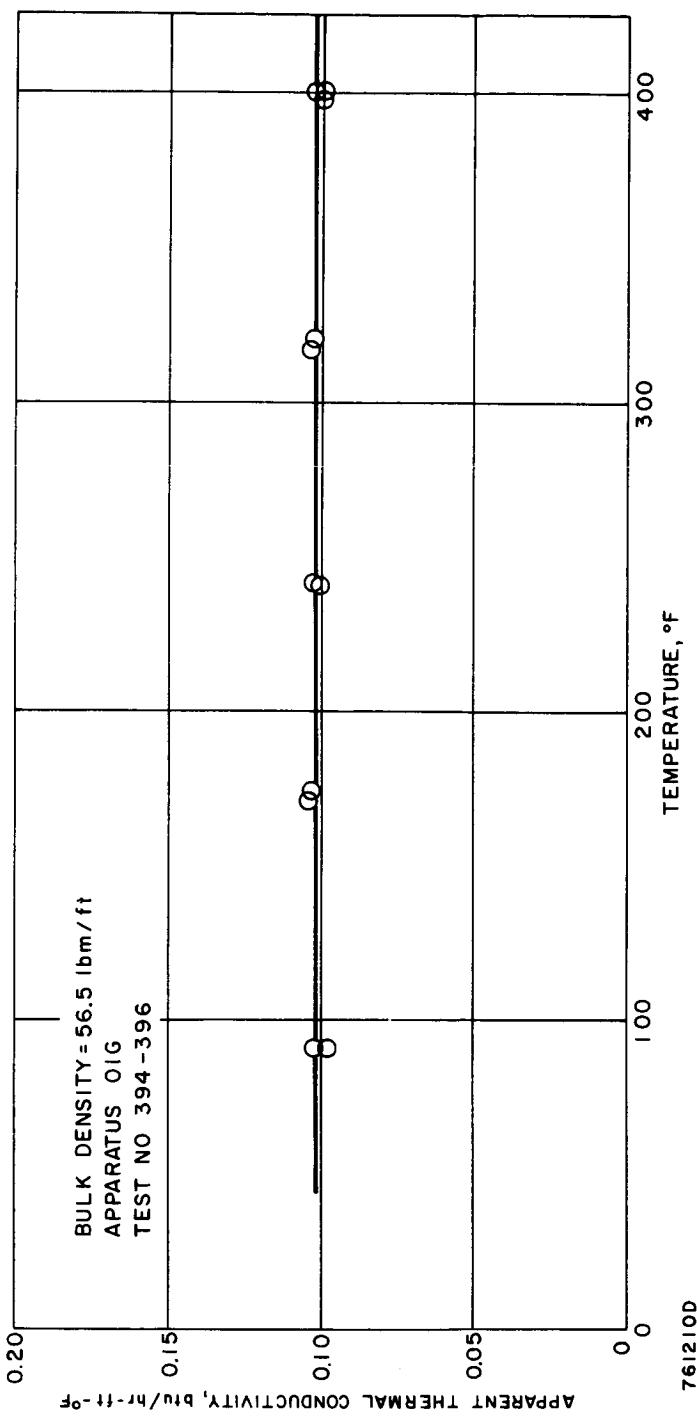


Figure 87 THERMAL CONDUCTIVITY VERSUS TEMPERATURE, DC325-  
3/16 HC WHITE BLEND

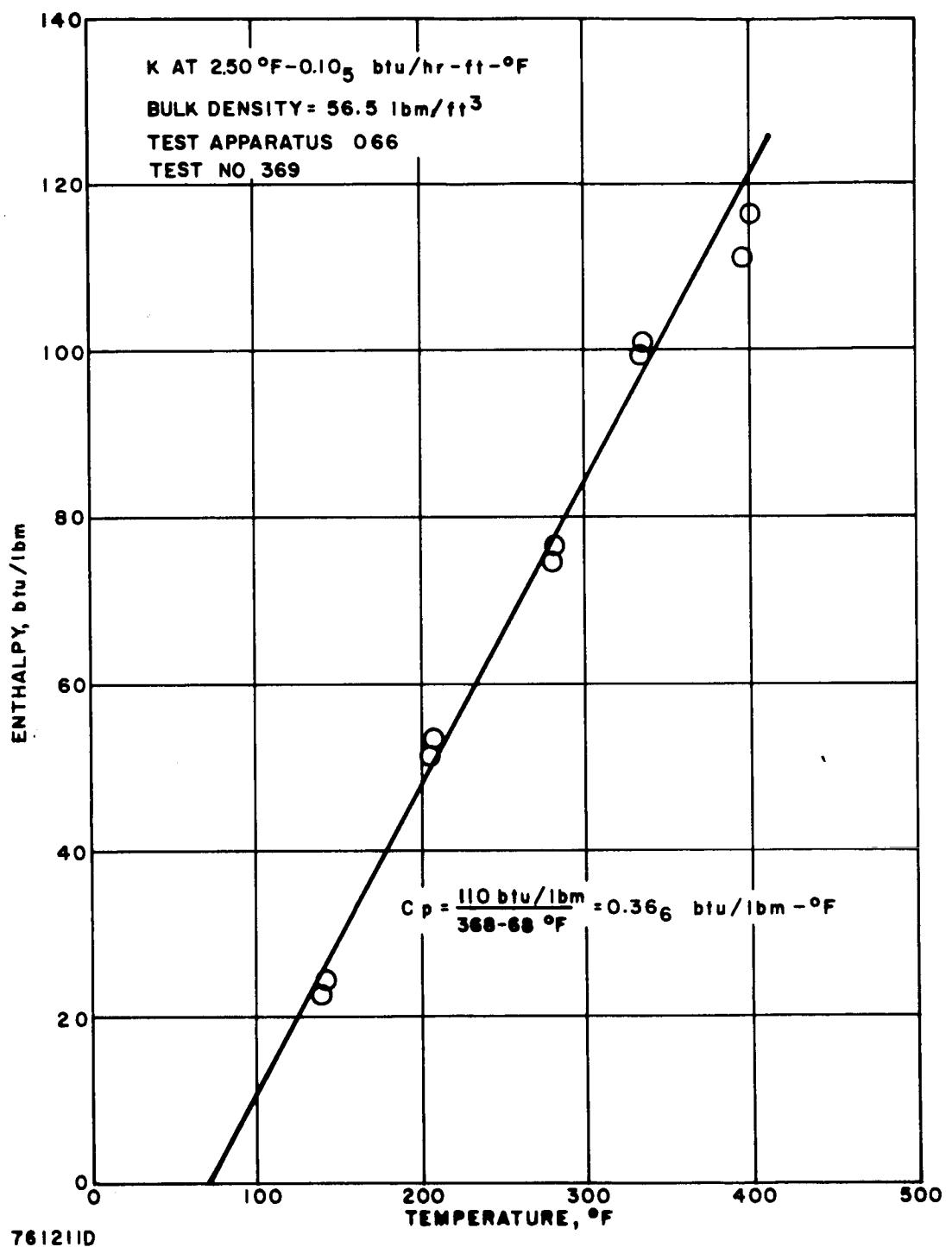


Figure 88 ENTHALPY - SPECIFIC HEAT VERSUS TEMPERATURE, DC325

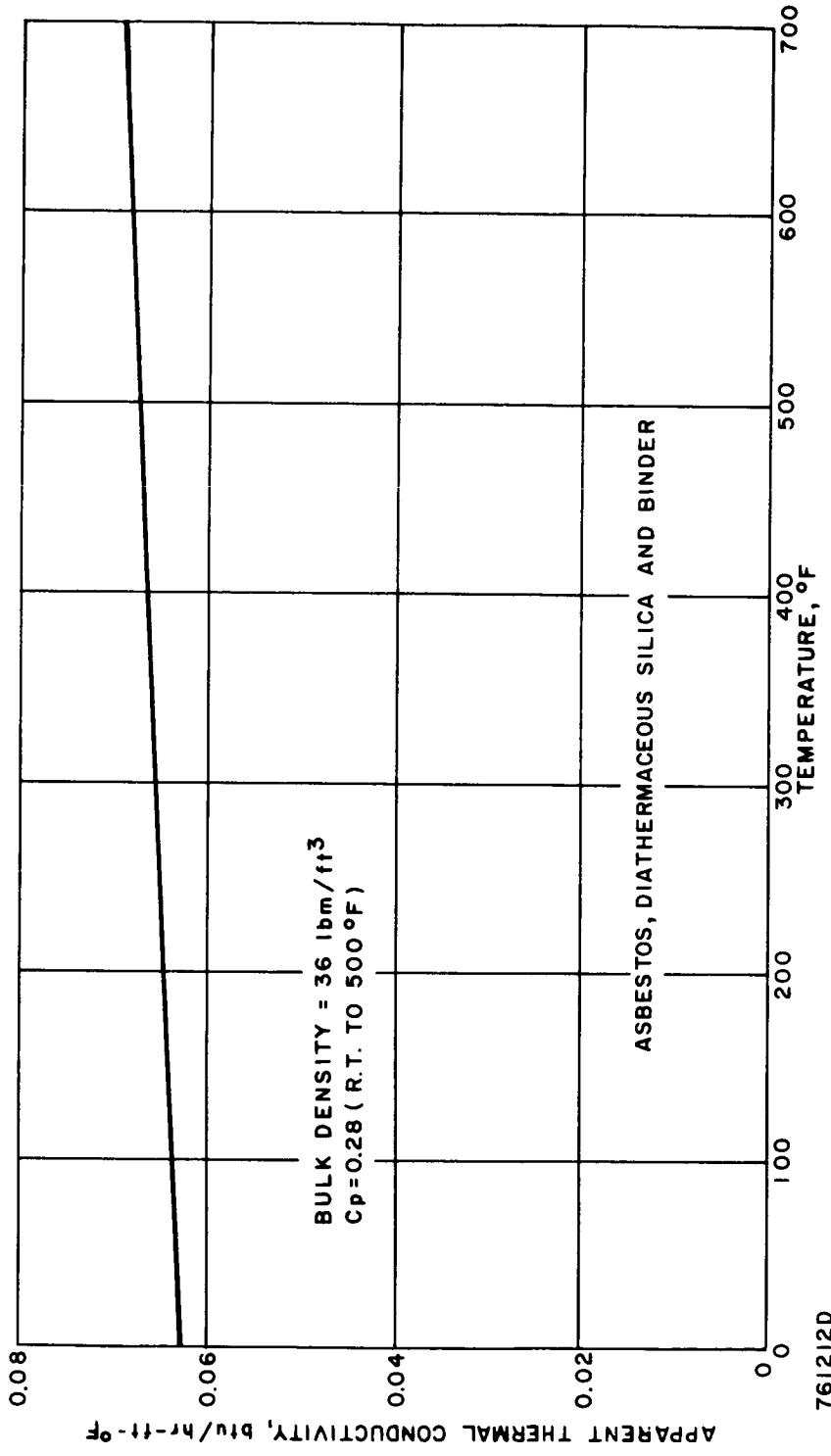


Figure 89 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
MARINITE

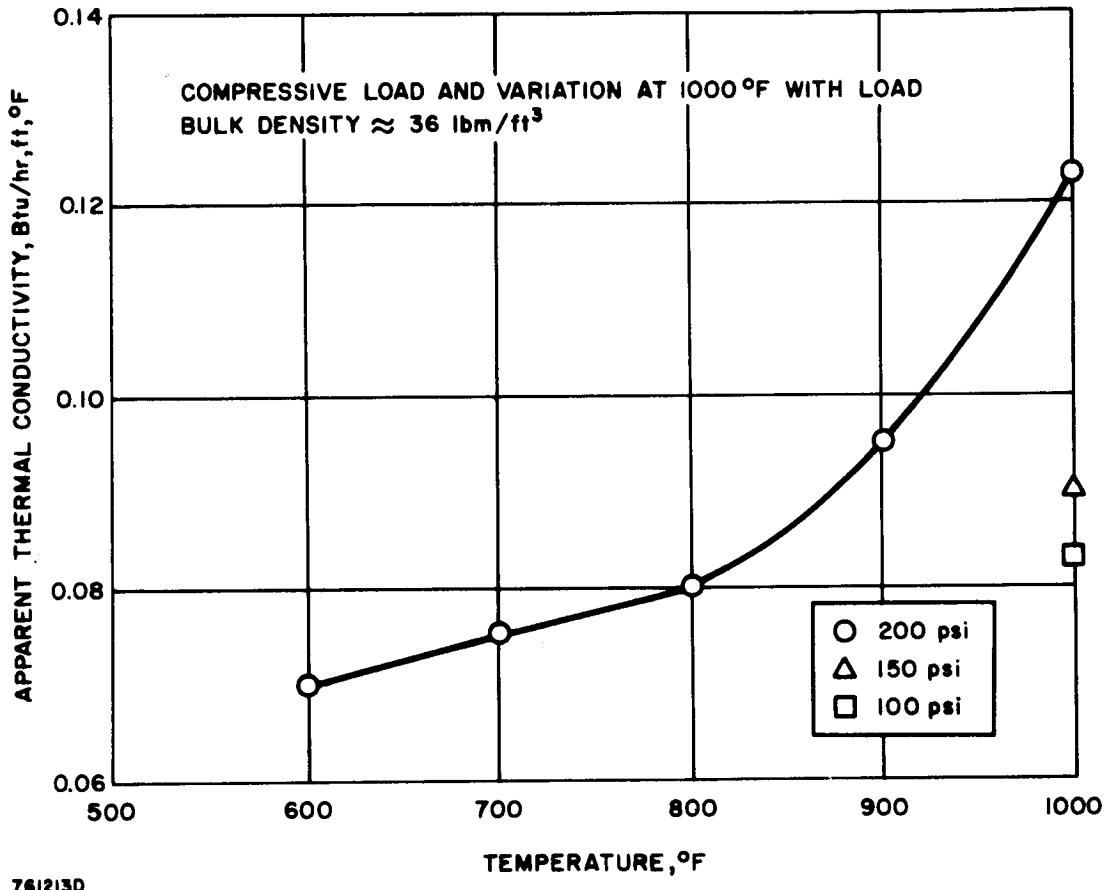


Figure 90 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
MARINITE TESTED AT VARIOUS LOAD PRESSURES

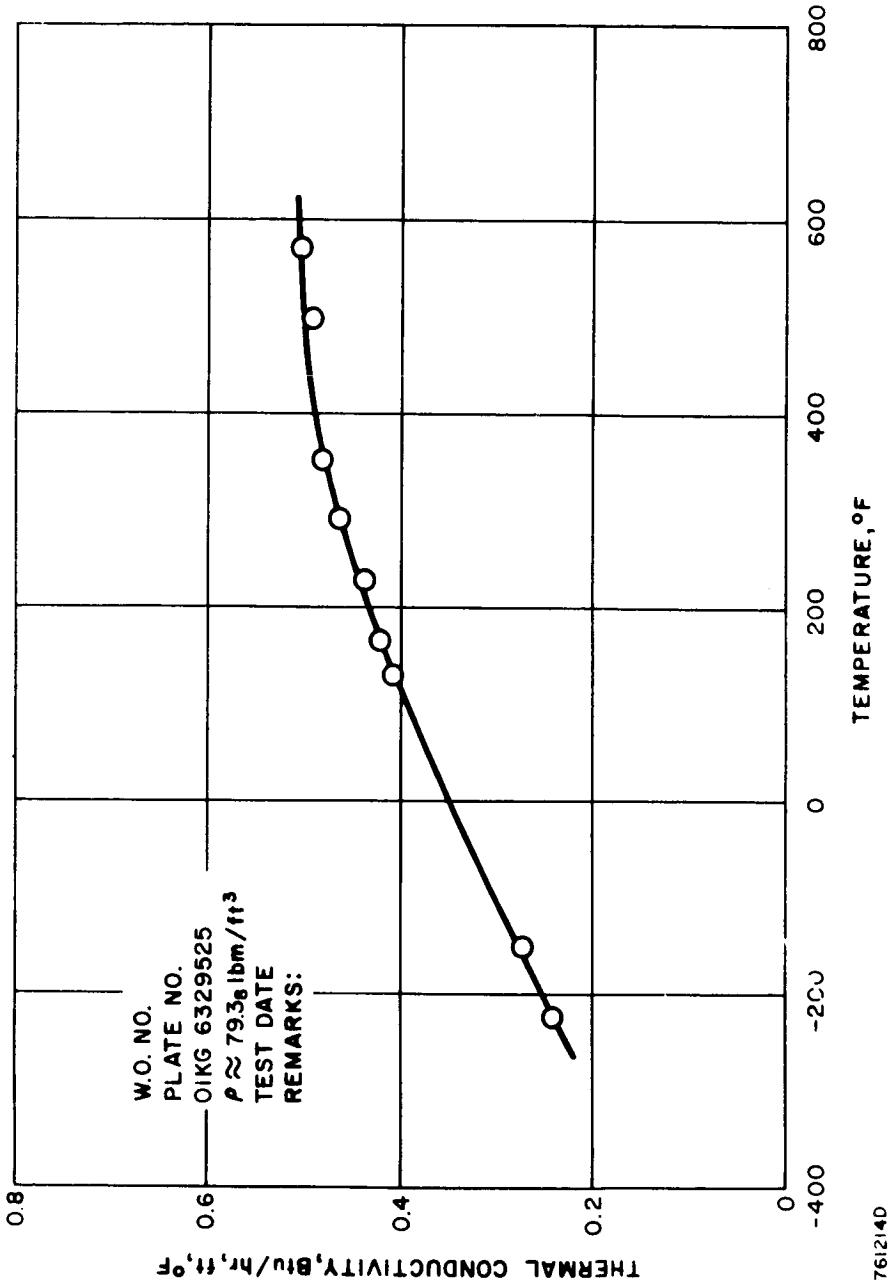


Figure 71 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
HT 424

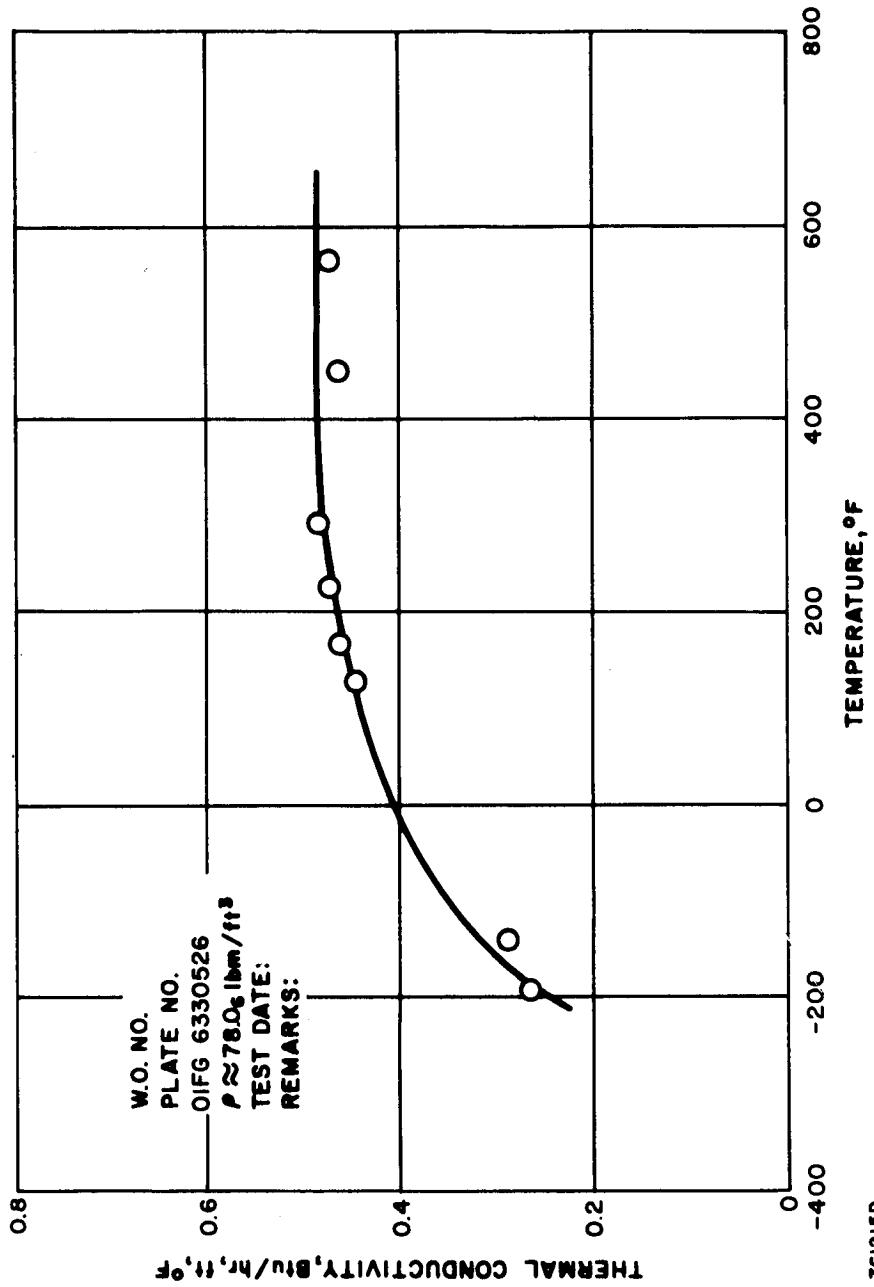


Figure 92 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
HT 424

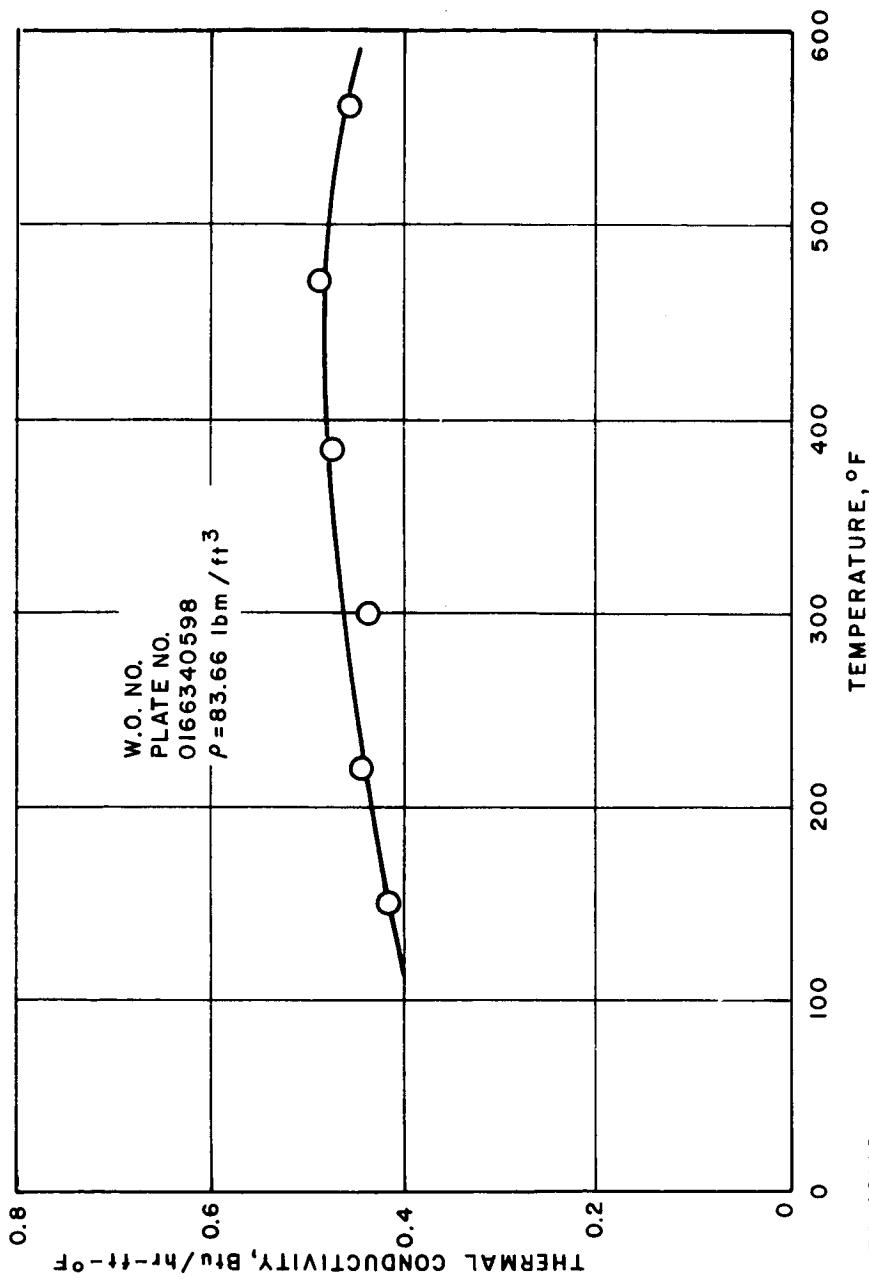


Figure 93 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
HT 424

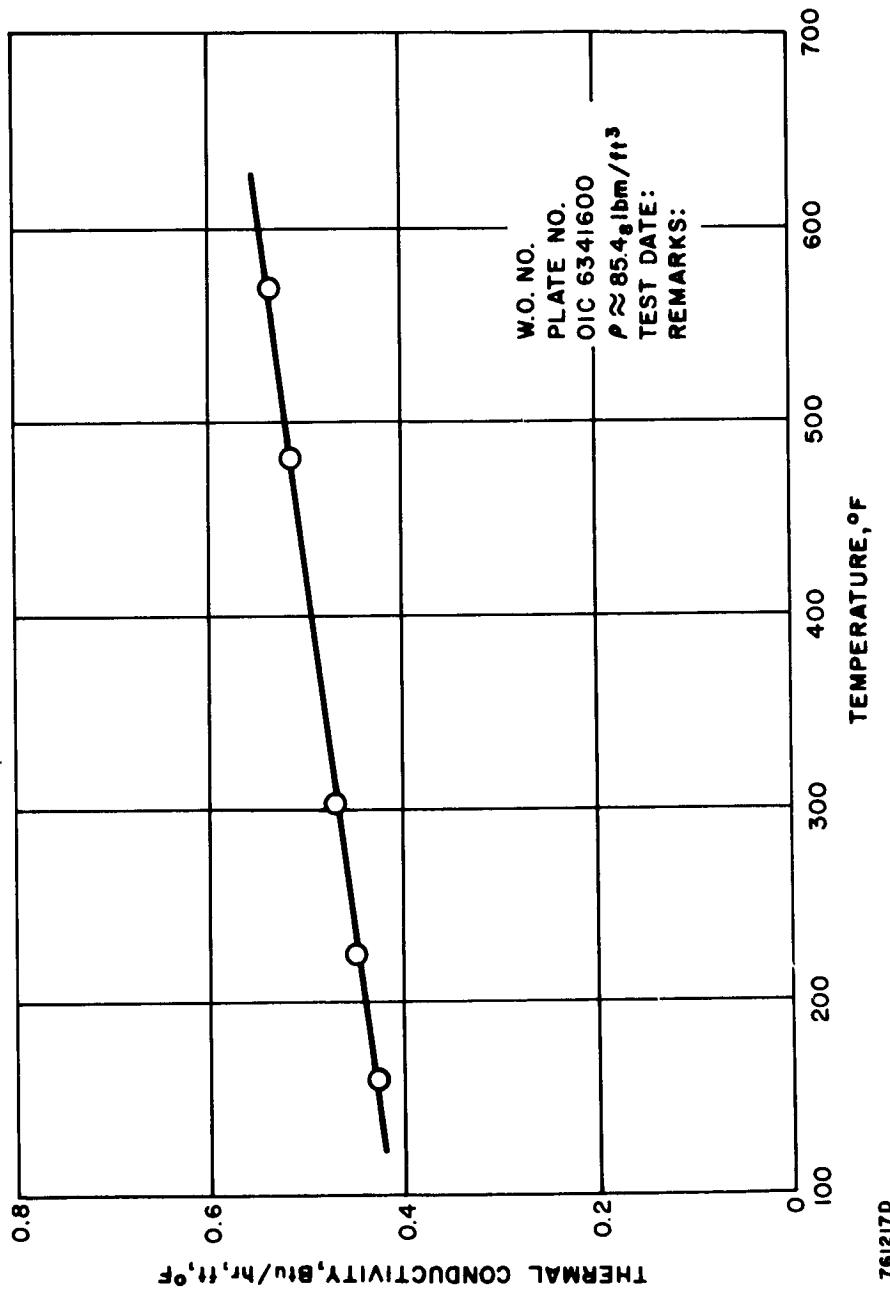


Figure 94 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
HT 424

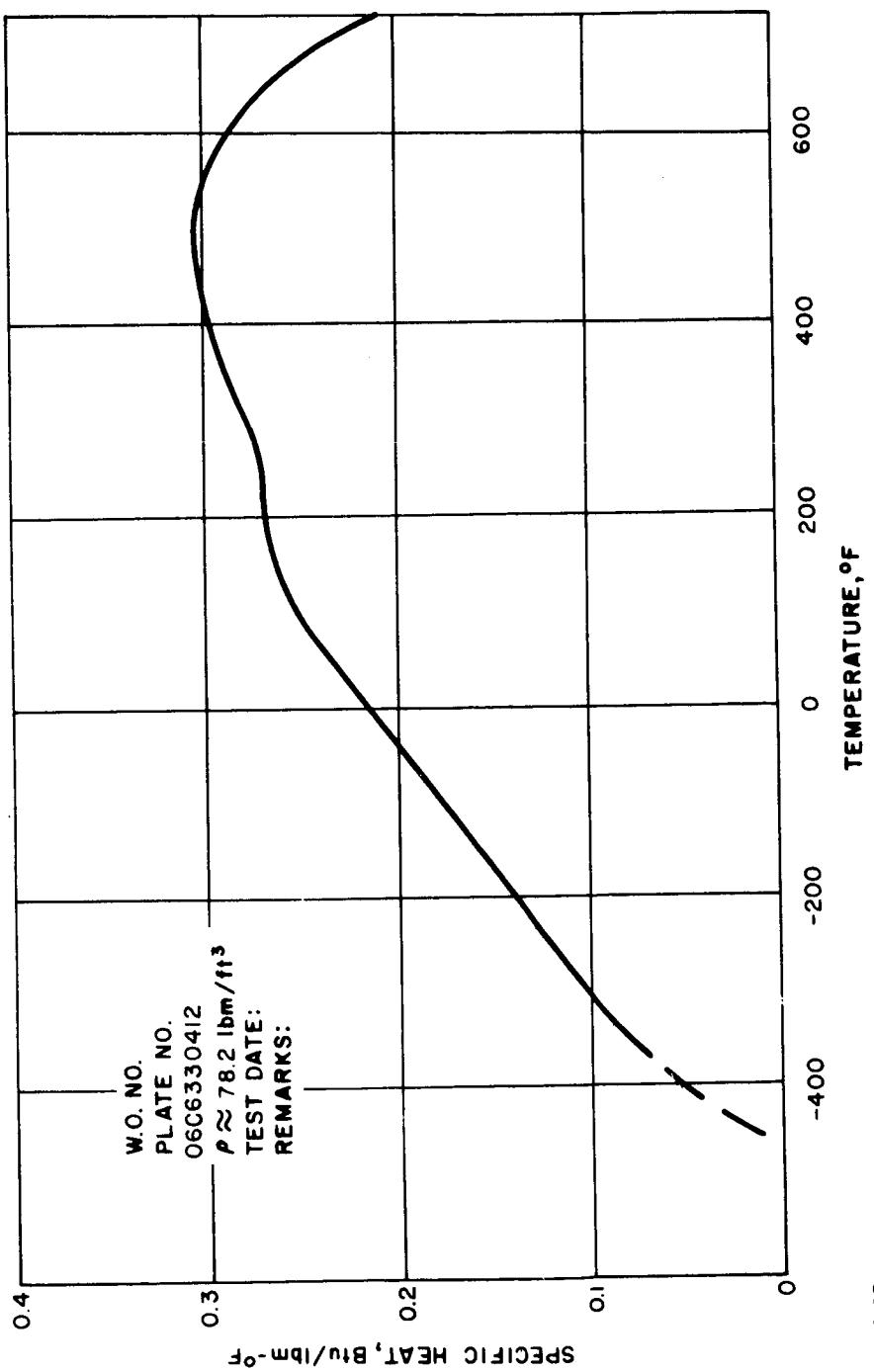


Figure 95 SPECIFIC HEAT VERSUS TEMPERATURE, HT 424

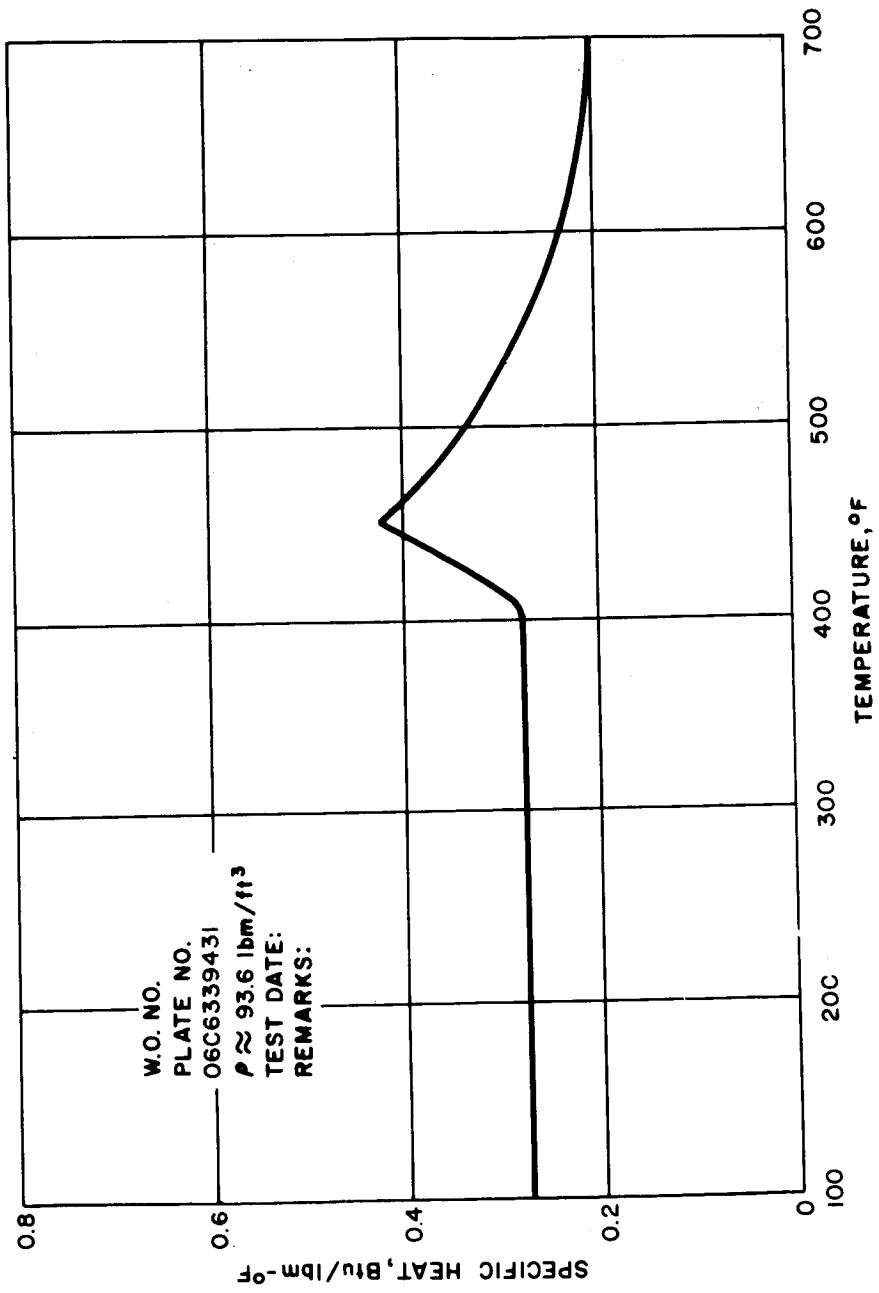


Figure 96 SPECIFIC HEAT VERSUS TEMPERATURE, HT 424

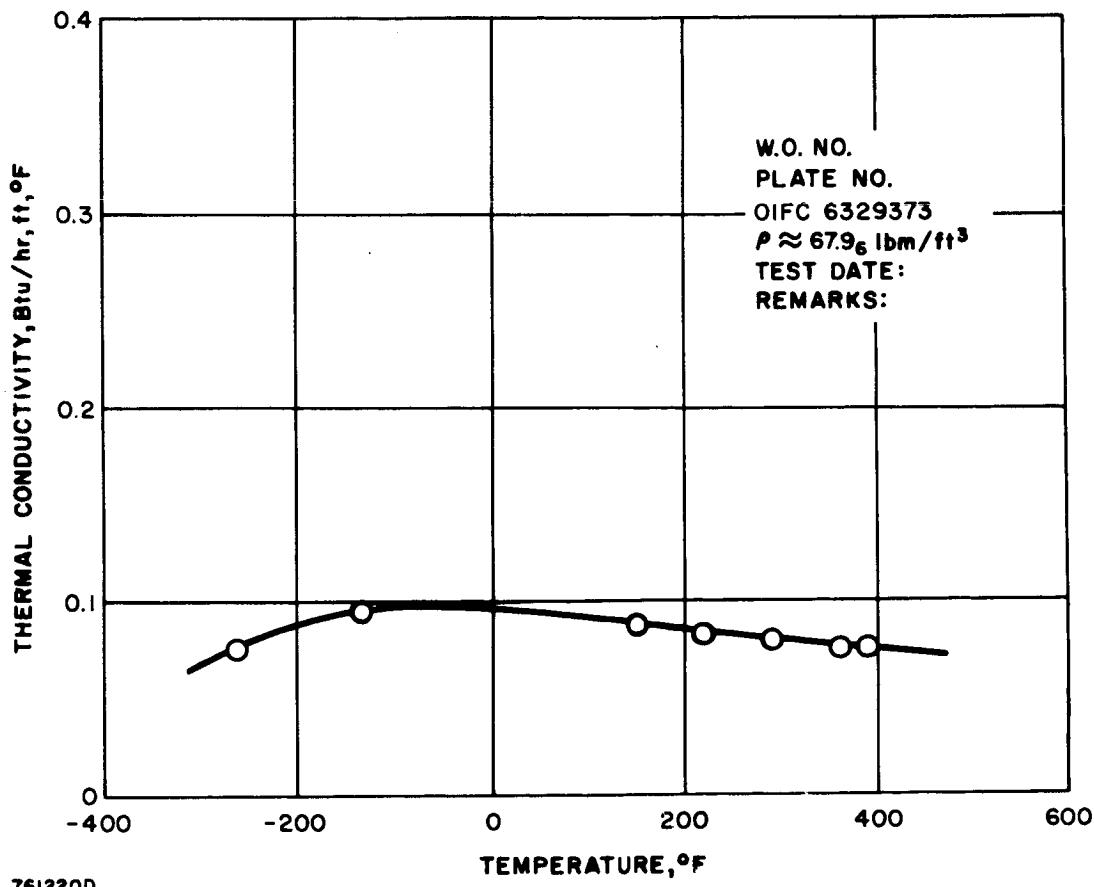


Figure 97 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
SYLGARD-182-2

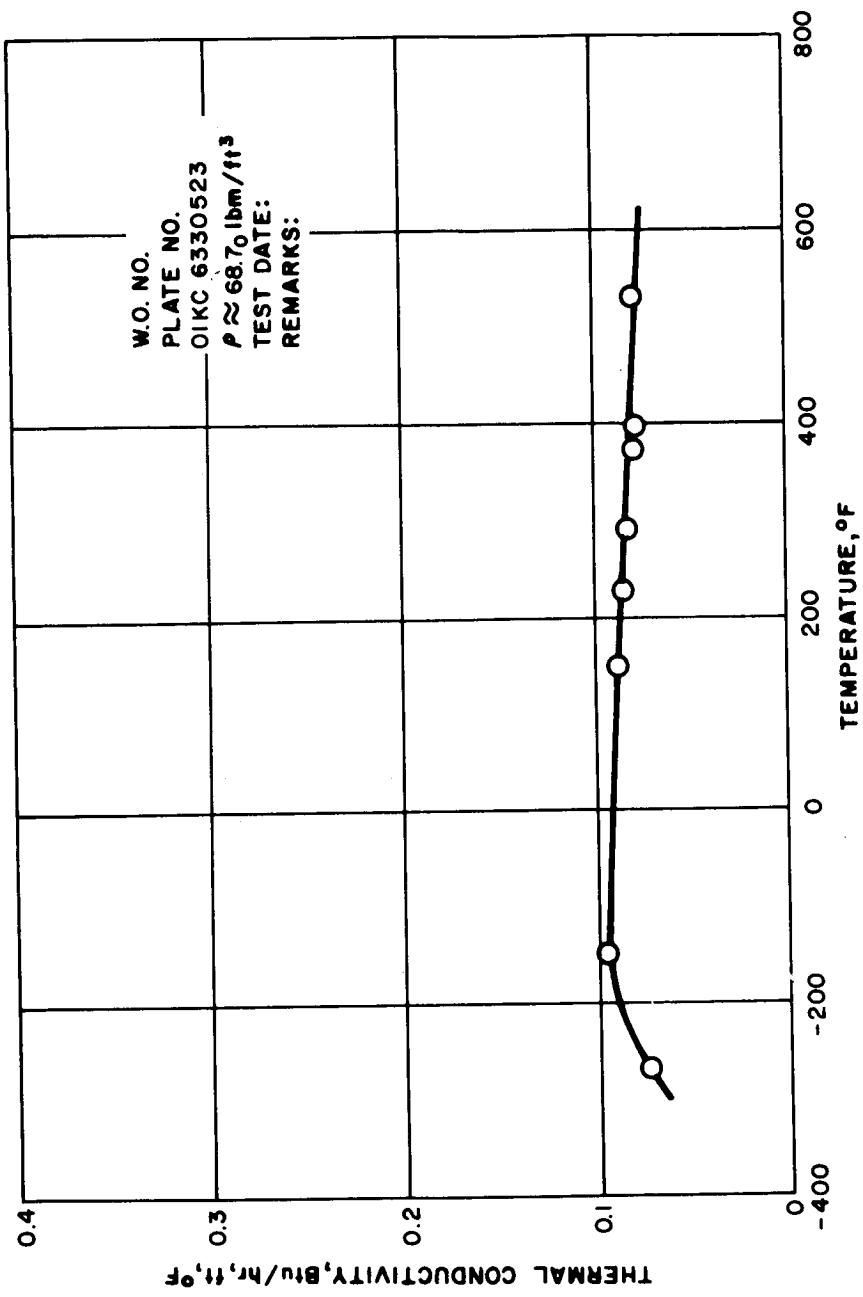


Figure 98 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
SYL GARD-182-2

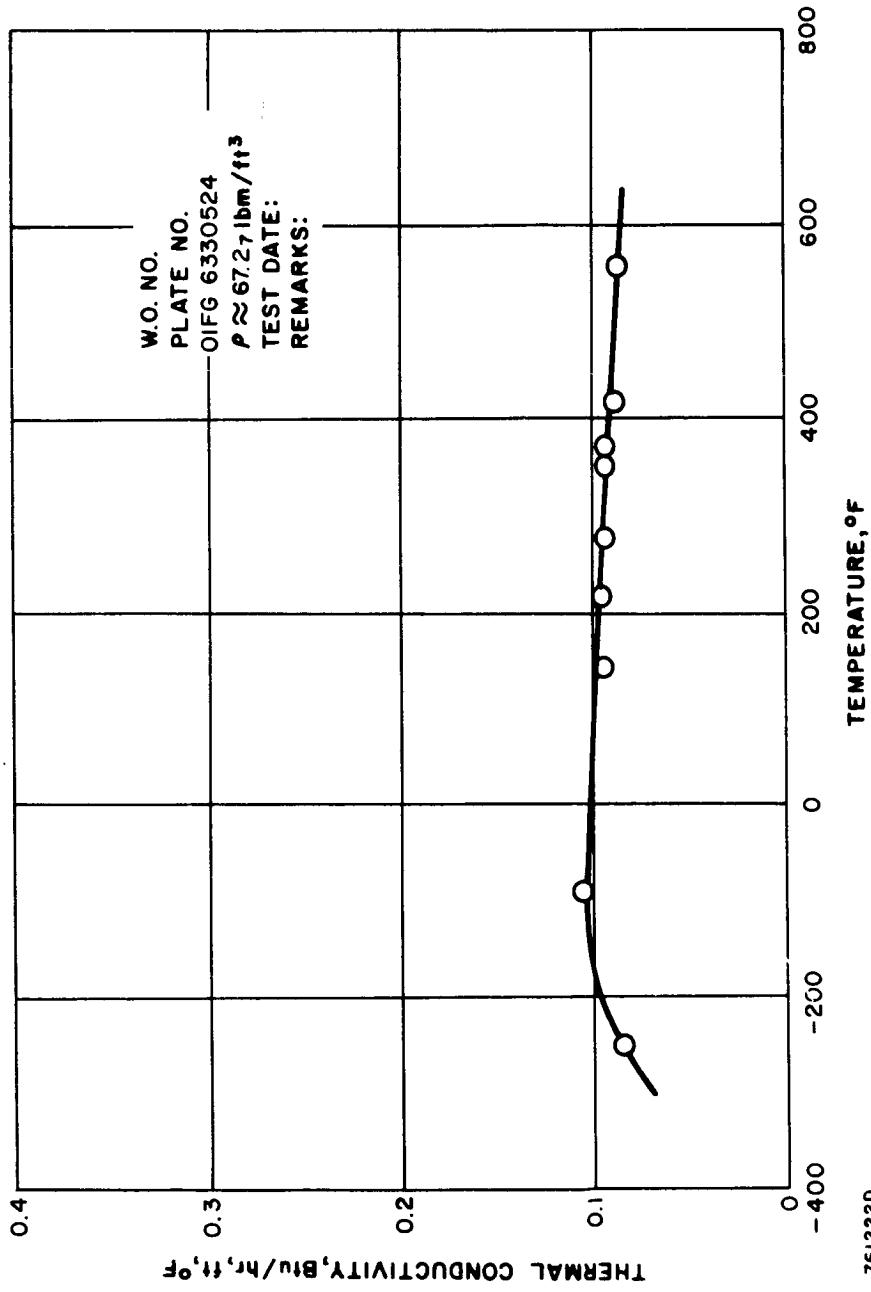


Figure 99 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
SYL GARD-182-2

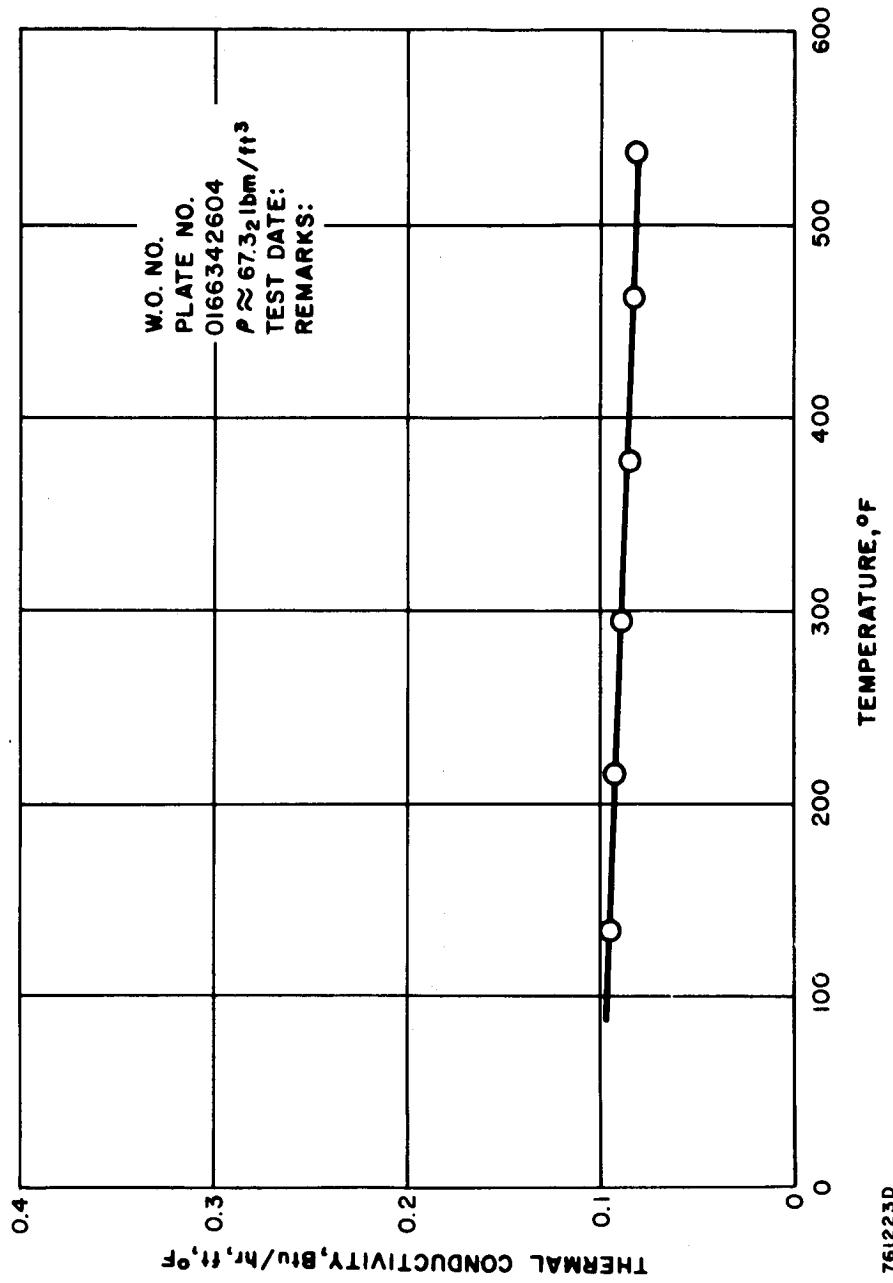


Figure 100 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
SYLGARD-182-2

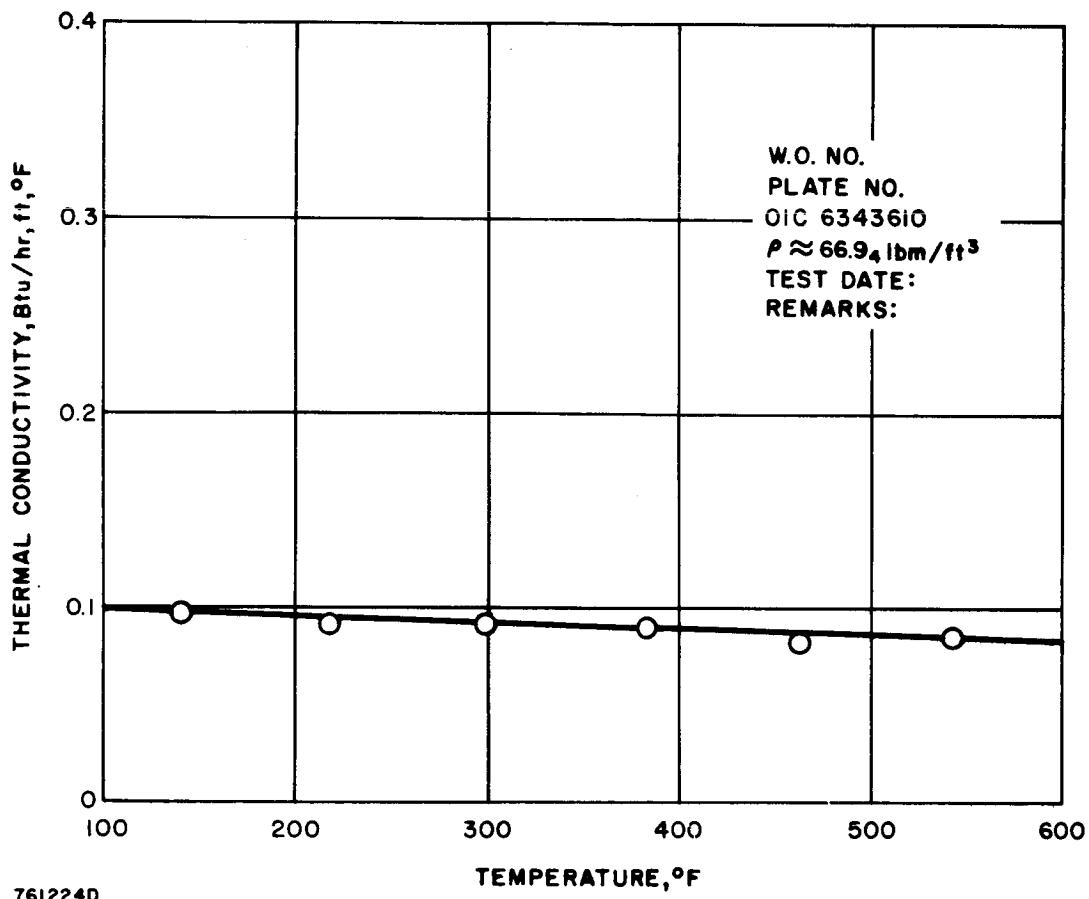


Figure 101 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
SYLGARD-182-2

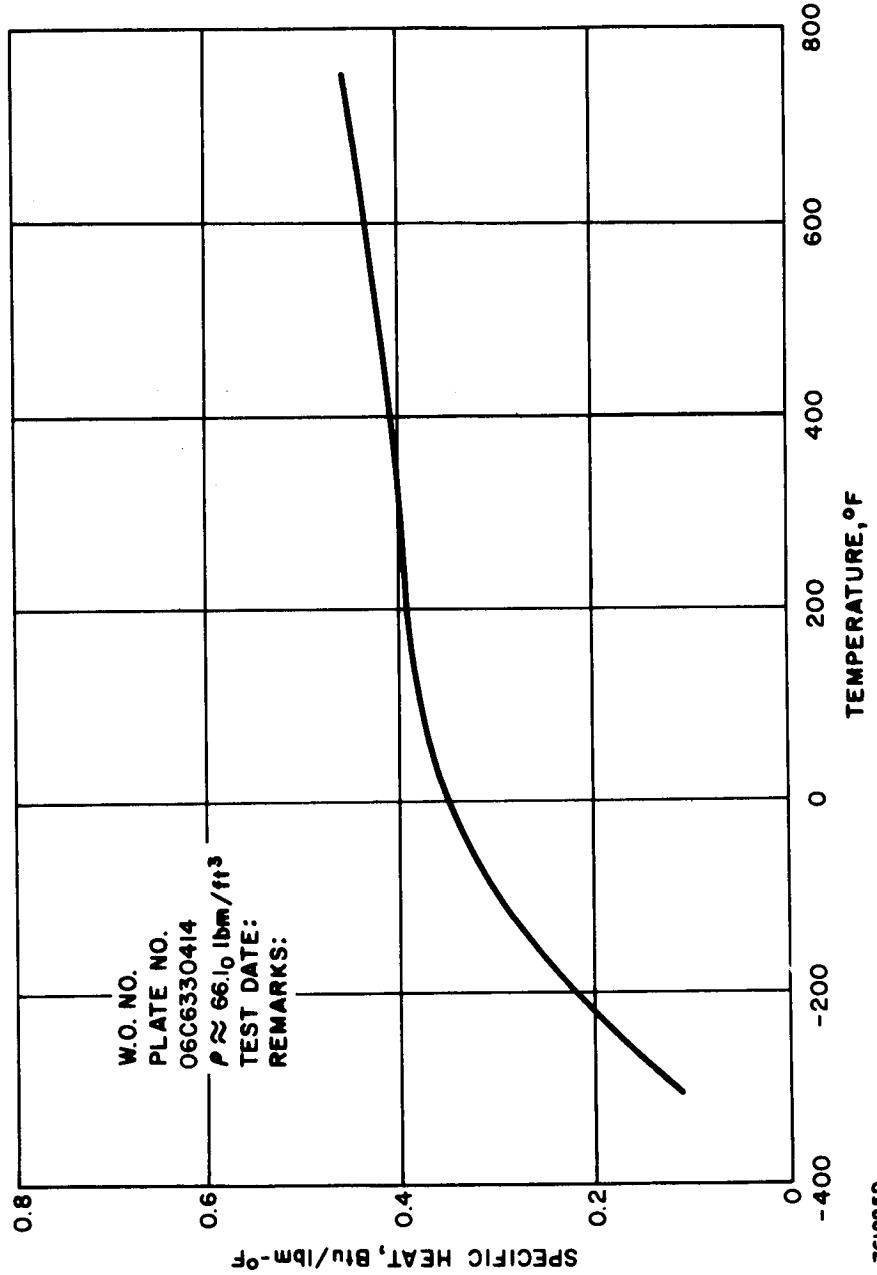


Figure 102 SPECIFIC HEAT VERSUS TEMPERATURE, SYLGARD-182-2

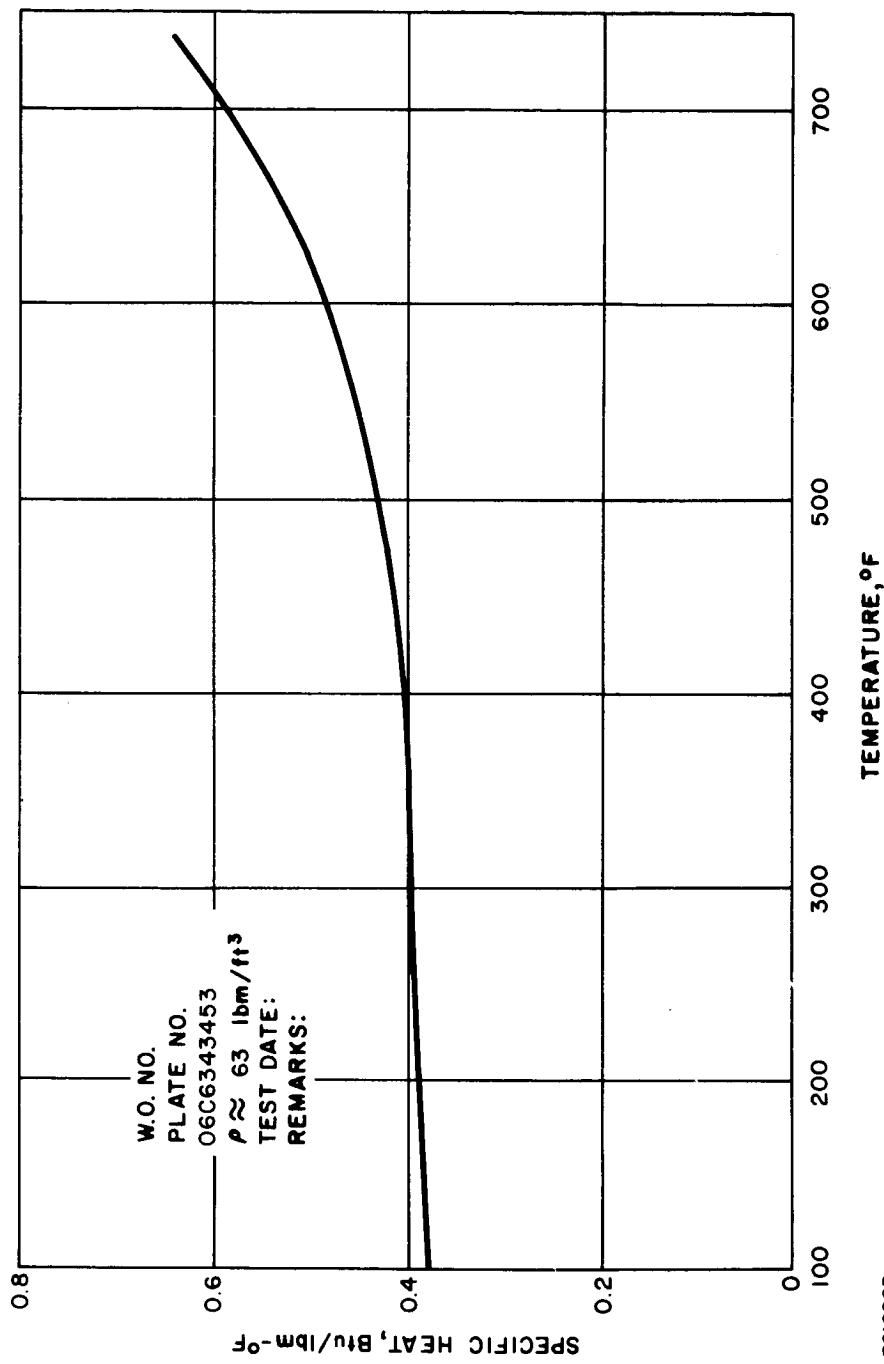


Figure 103 SPECIFIC HEAT VERSUS TEMPERATURE, SYLGARD-182-2

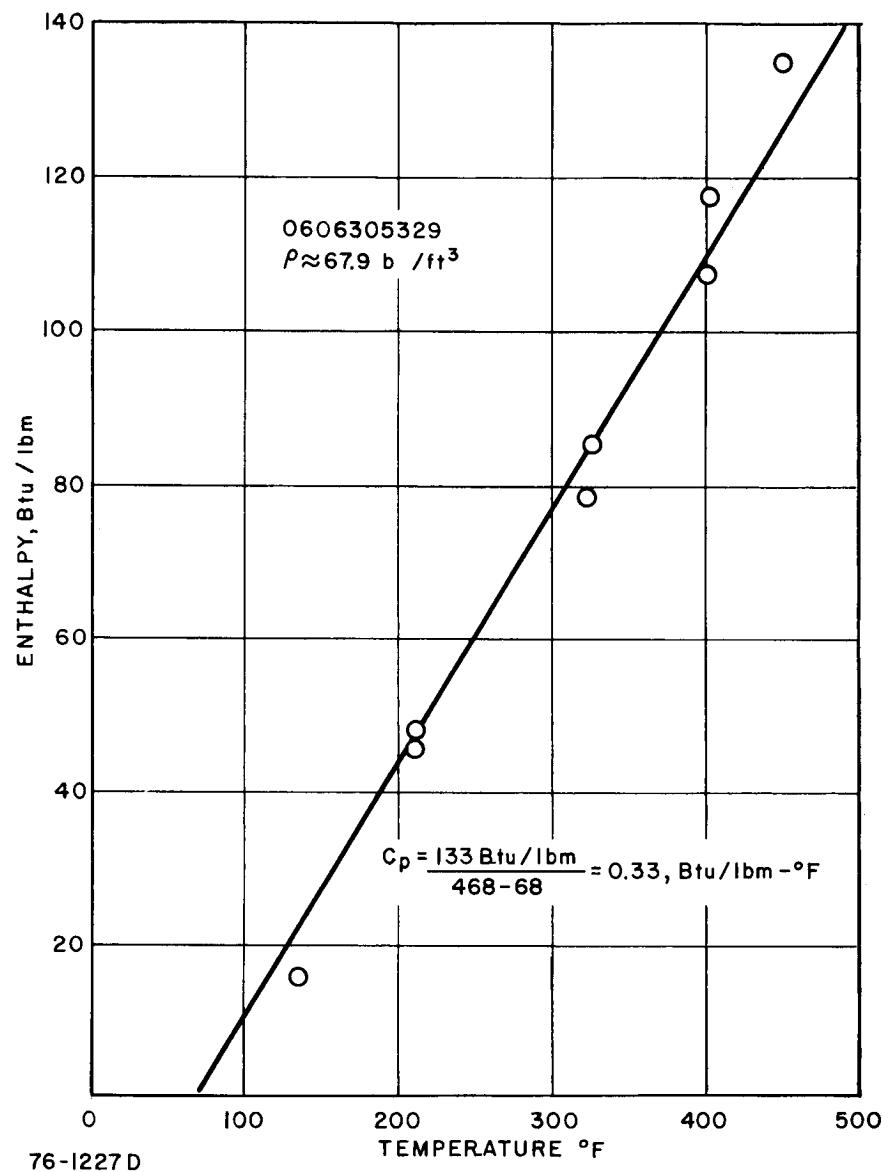


Figure 104 ENTHALPY - SPECIFIC HEAT VERSUS TEMPERATURE, SYLGARD-182-2

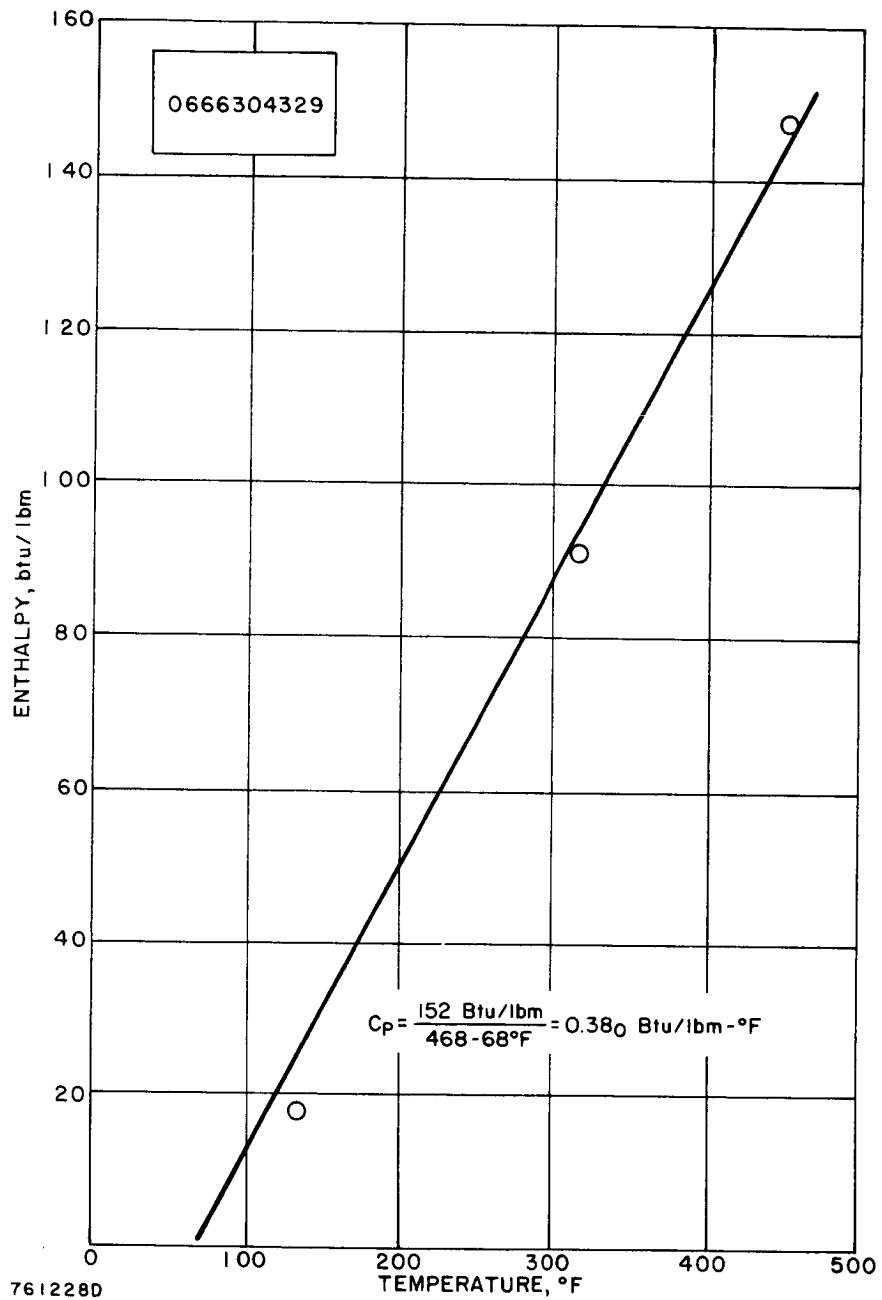


Figure 105 ENTHALPY - SPECIFIC HEAT VERSUS TEMPERATURE, SYLGARD-182-2

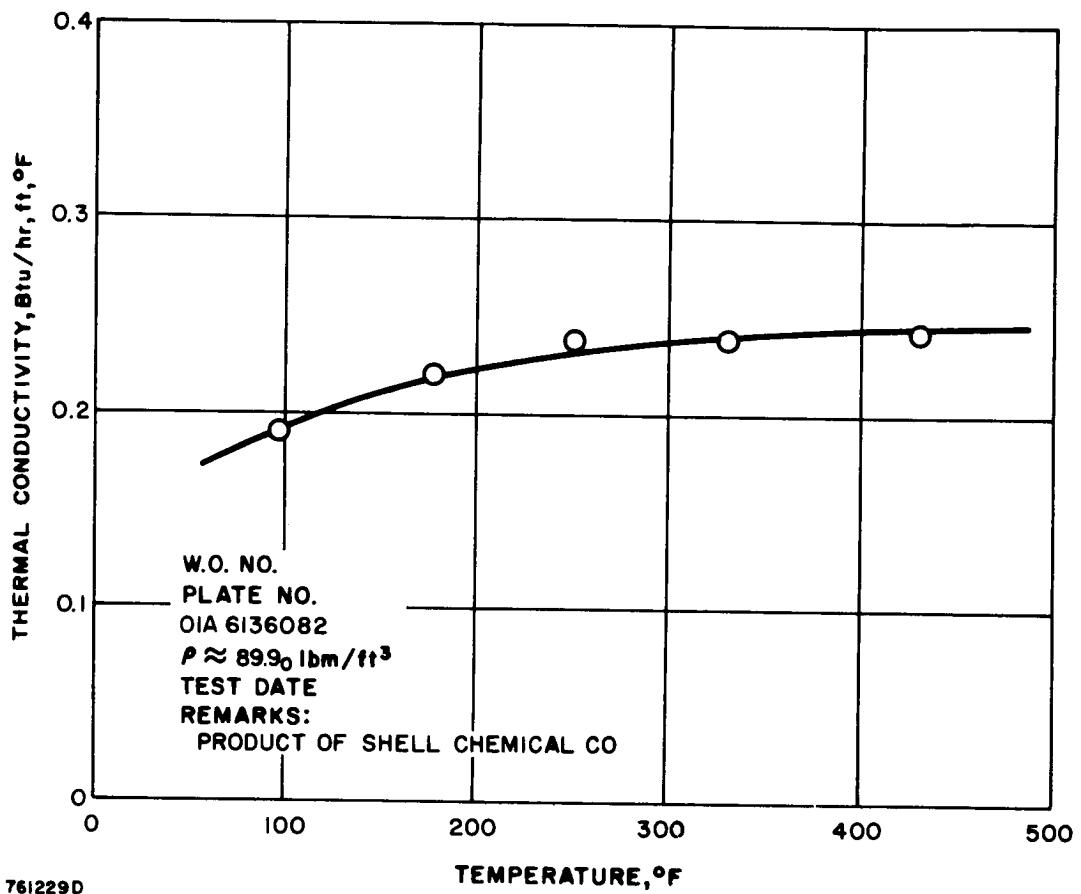
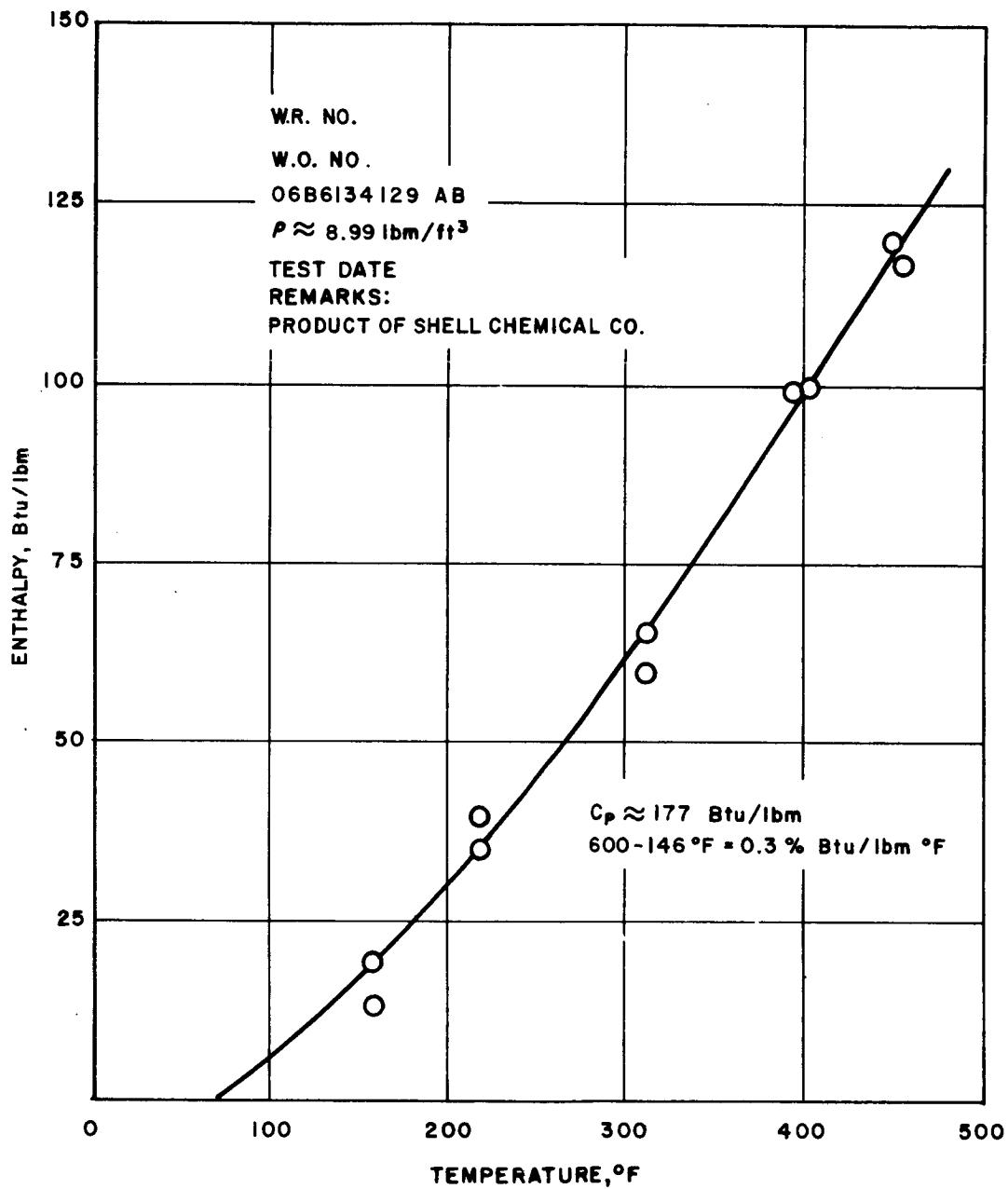


Figure 106 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
EPON 931



761230 D

Figure 107 ENTHALPY - SPECIFIC HEAT VERSUS TEMPERATURE, EPON 931

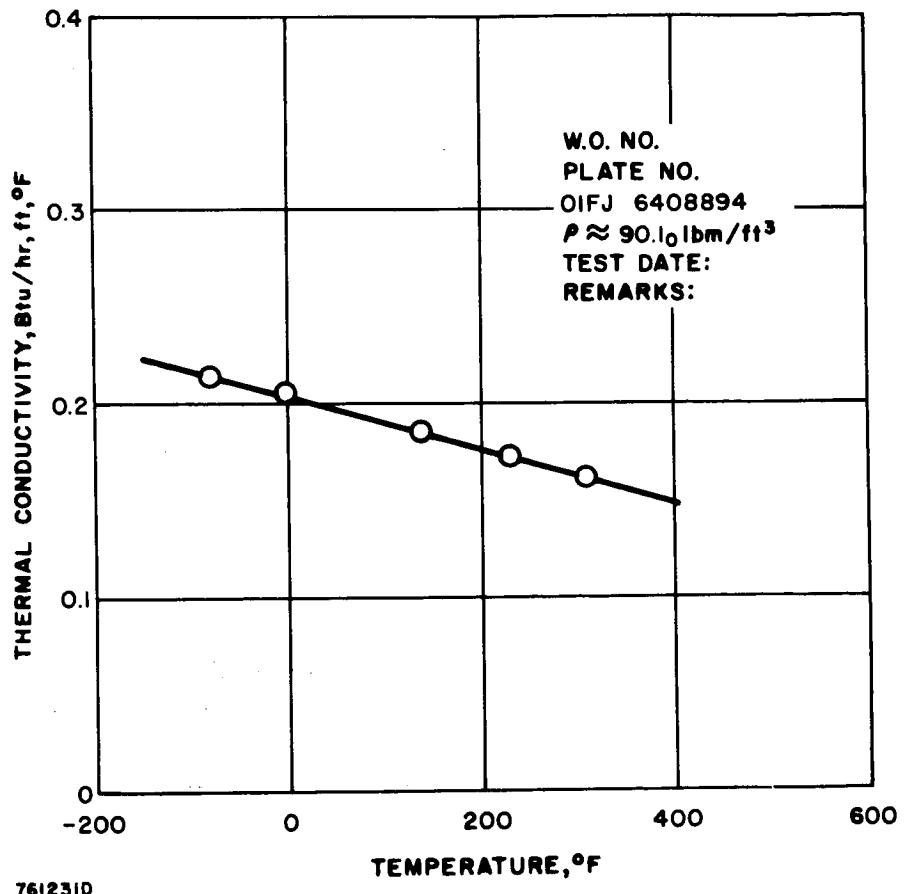


Figure 108 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
RTV 560

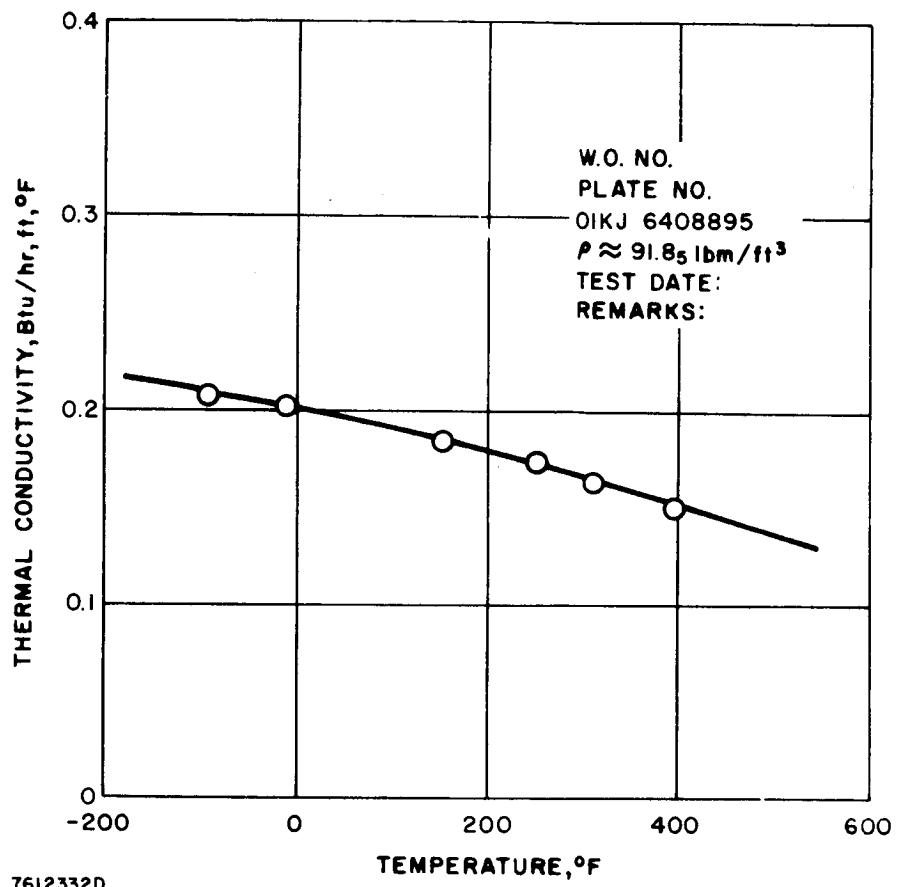


Figure 109 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
RTV 560

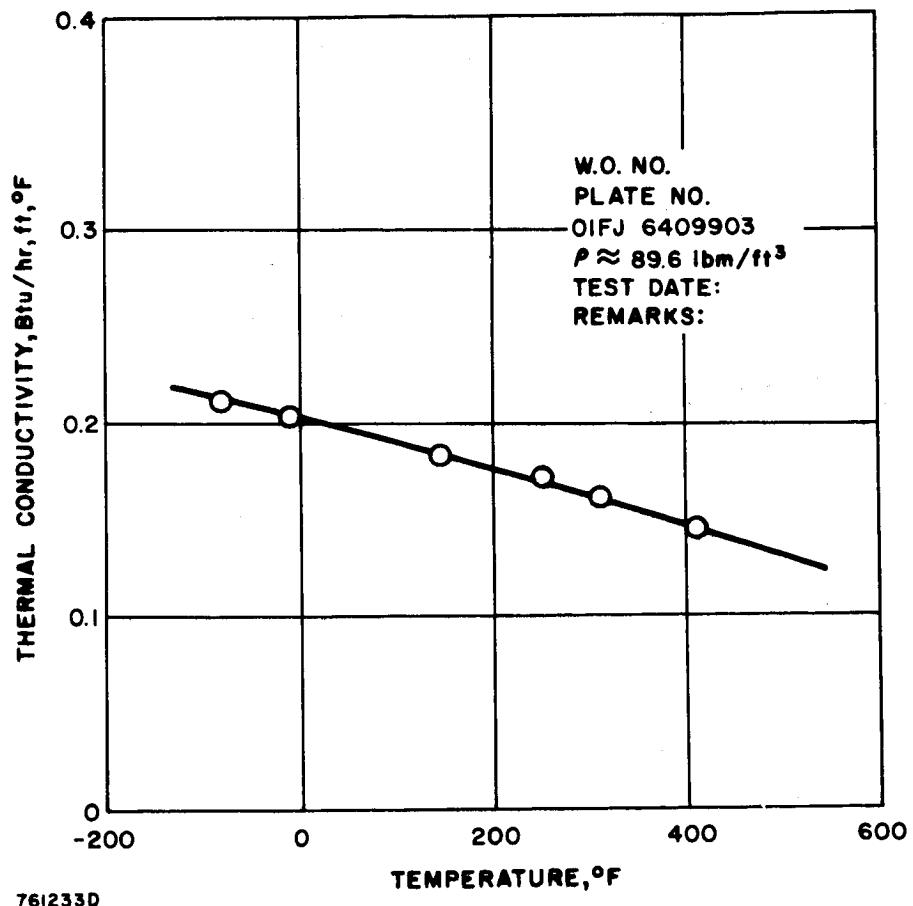
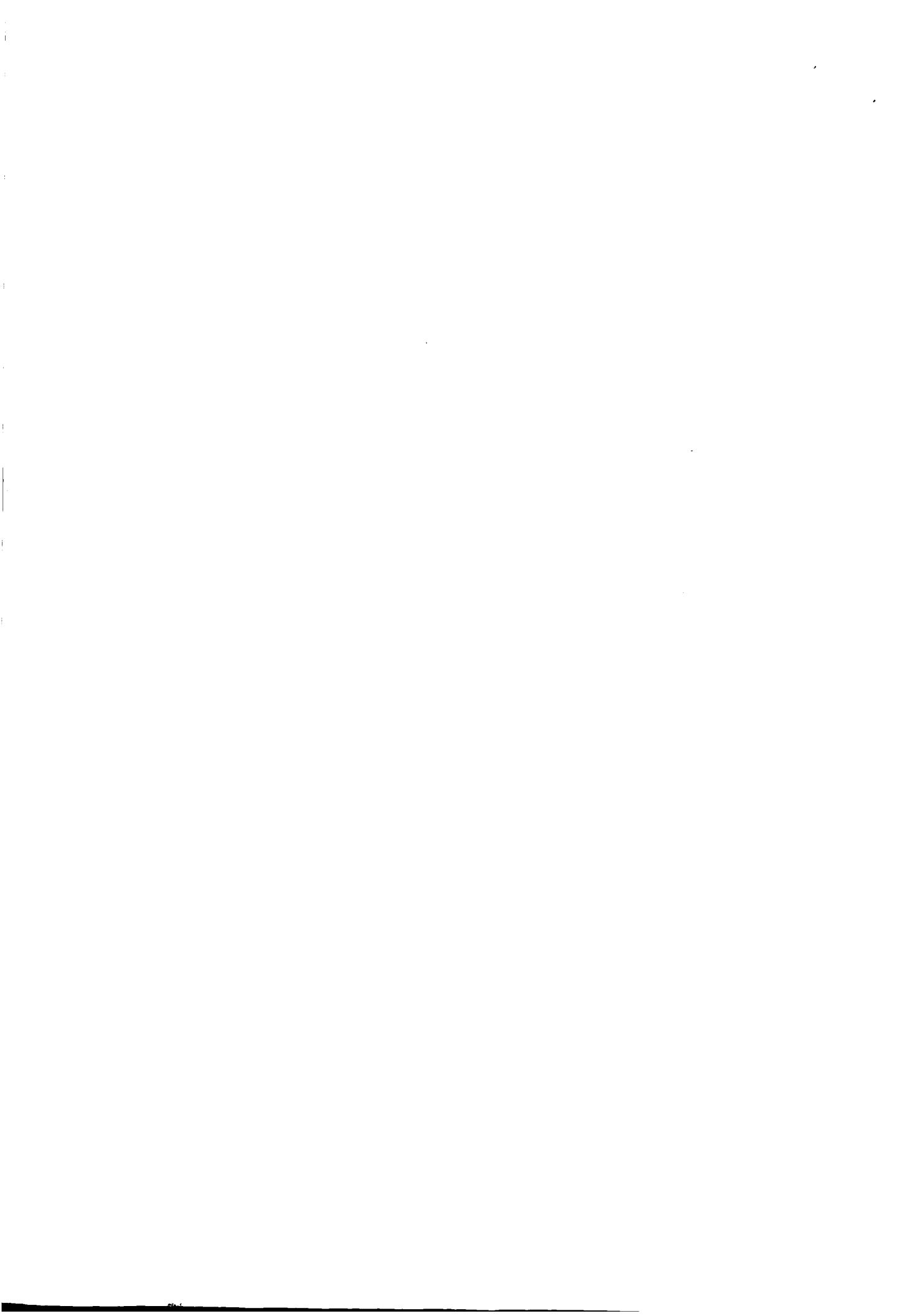


Figure 110 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
RTV 560



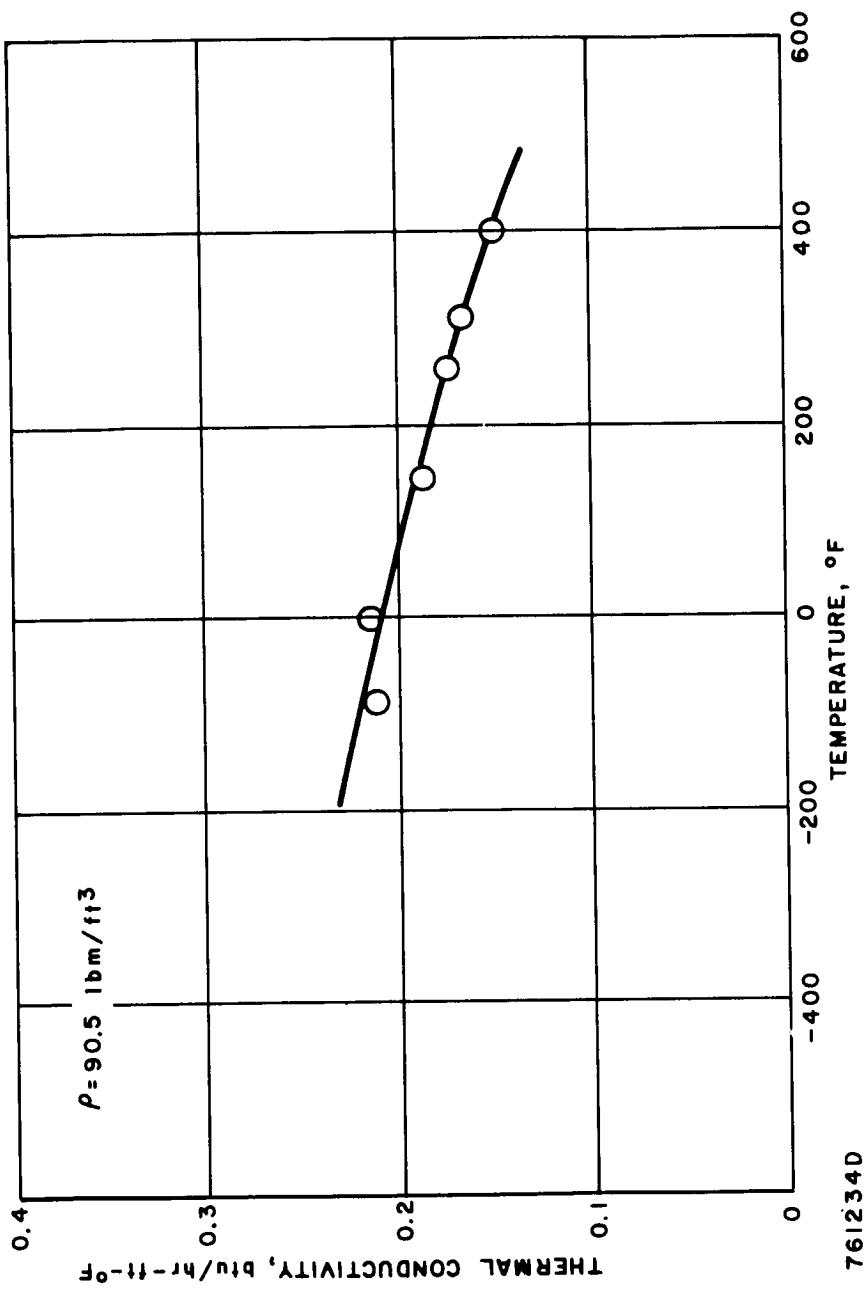


Figure 111 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE,  
 RTV 560

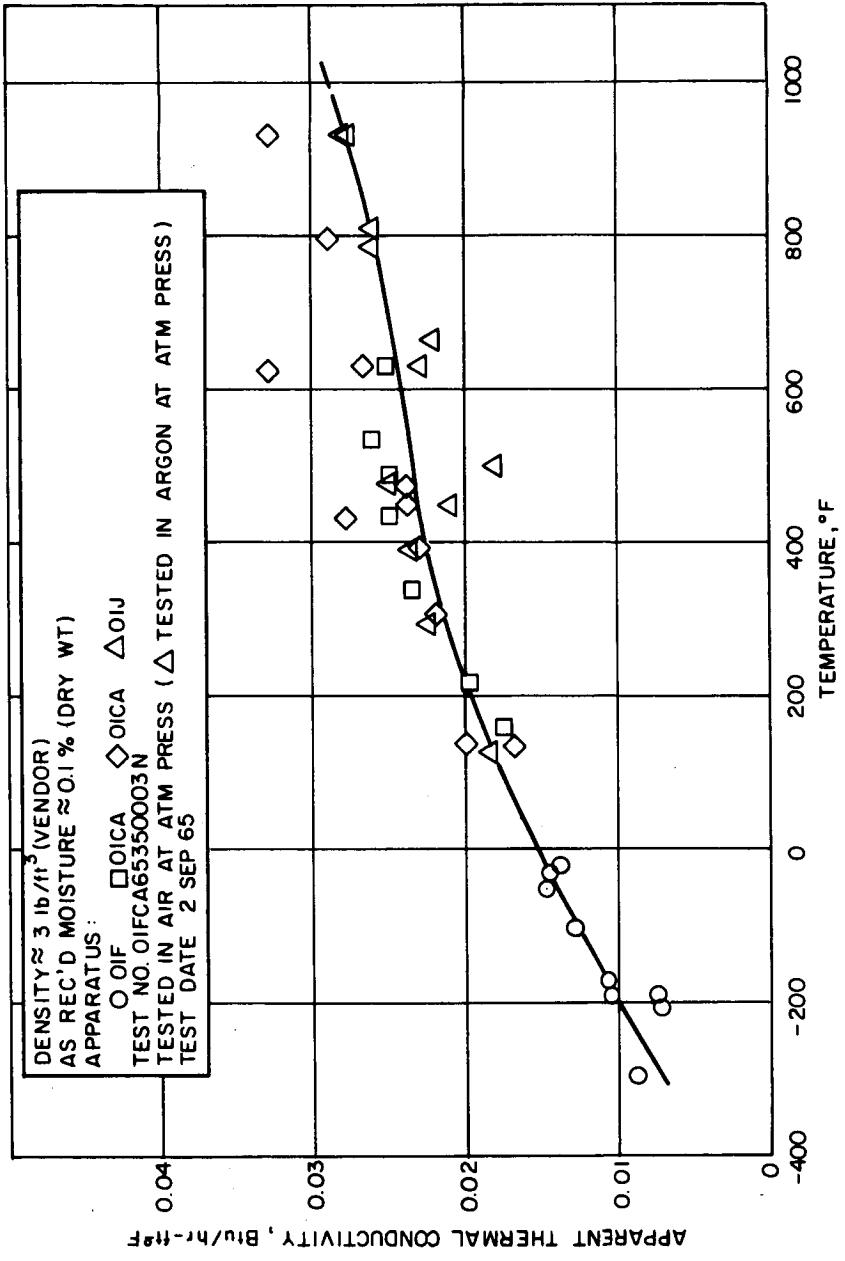
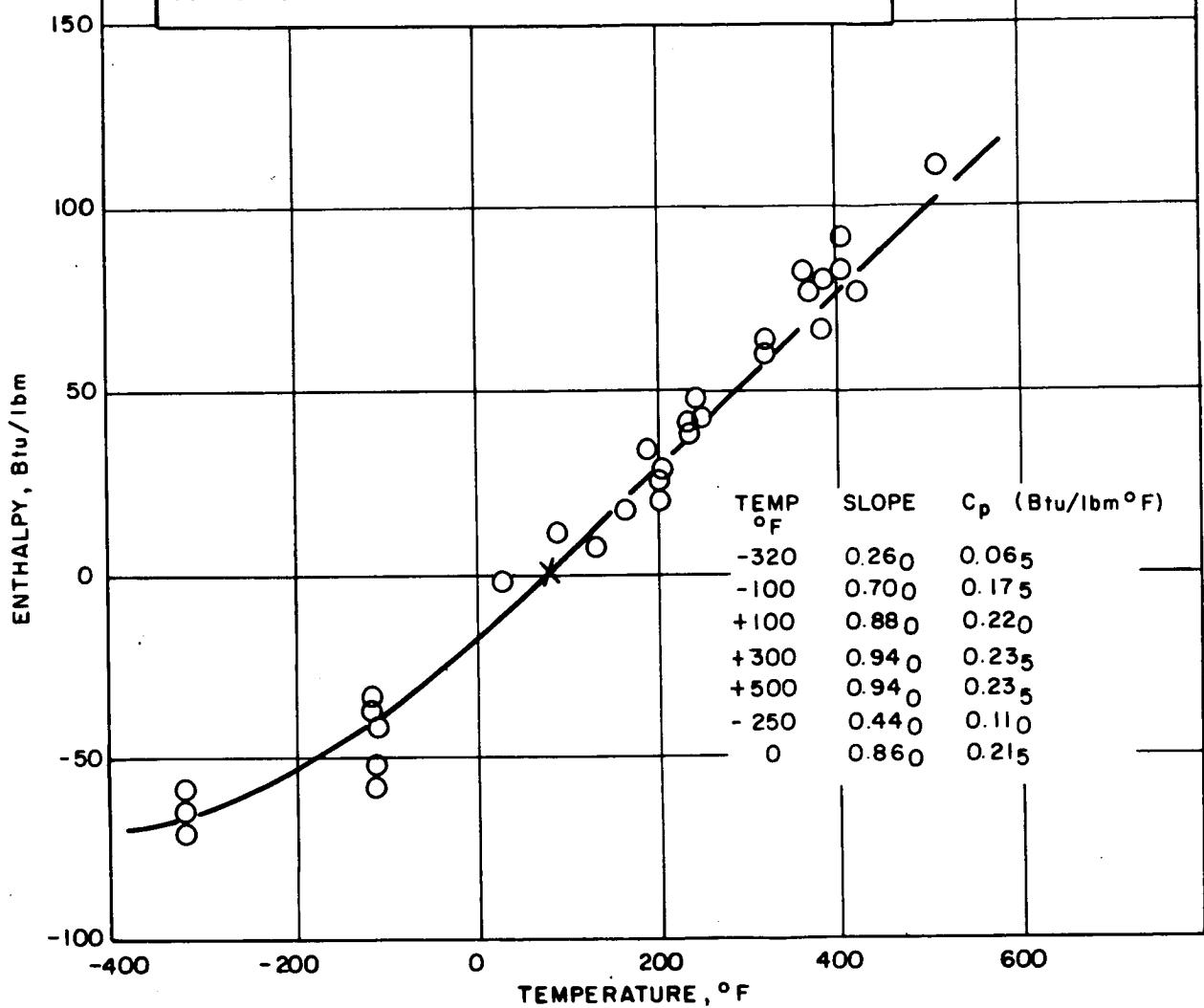


Figure 112 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE, TG15000

CONTRACT NO. NAS 94874  
 DENS ~ 3 lb/ft<sup>3</sup> (VENDOR)  
 06665350002N  
 TESTED 1 SEP 65 IN AIR AT ATM PRESS  
 SPECIMENS COMPACTED INTO ALUMINUM FOIL CAPSULES  
 CORRECTED ACCORDINGLY



760986D

Figure 113 ENTHALPY-SPECIFIC HEAT VERSUS TEMPERATURE, TG15000

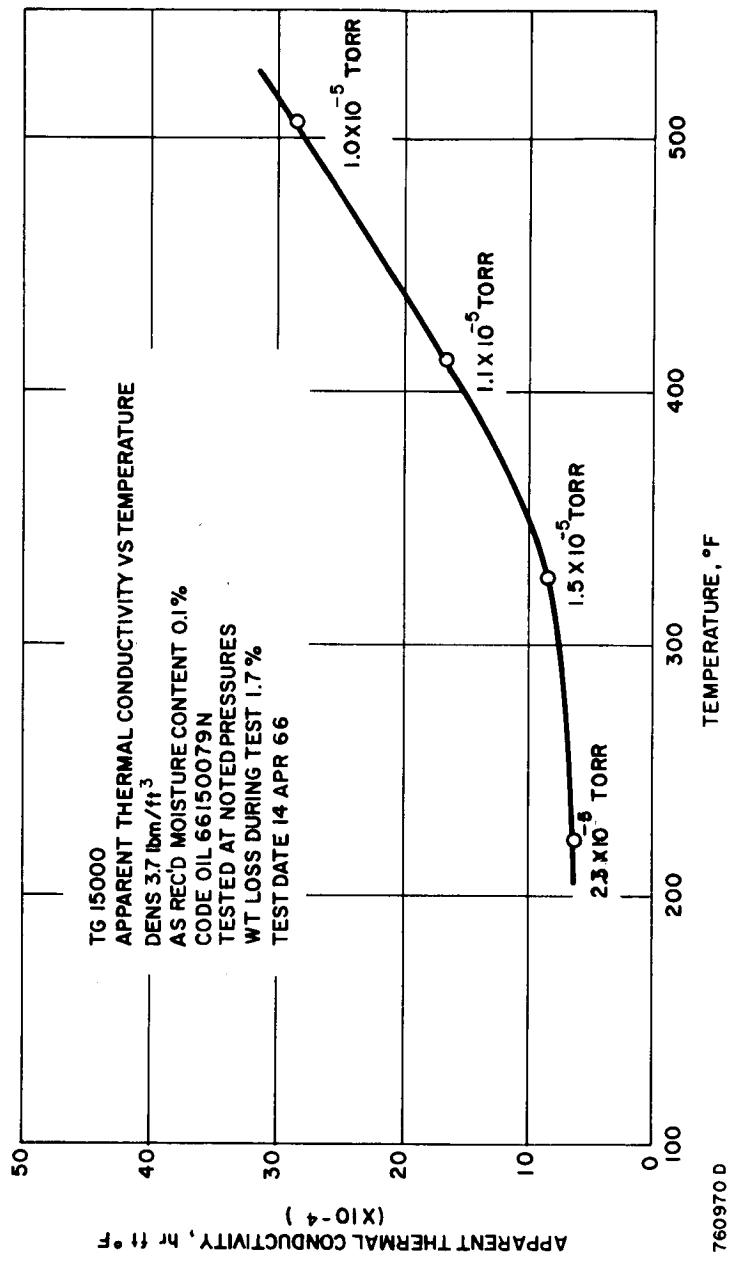


Figure 114 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE, TG15000 (VACUUM)

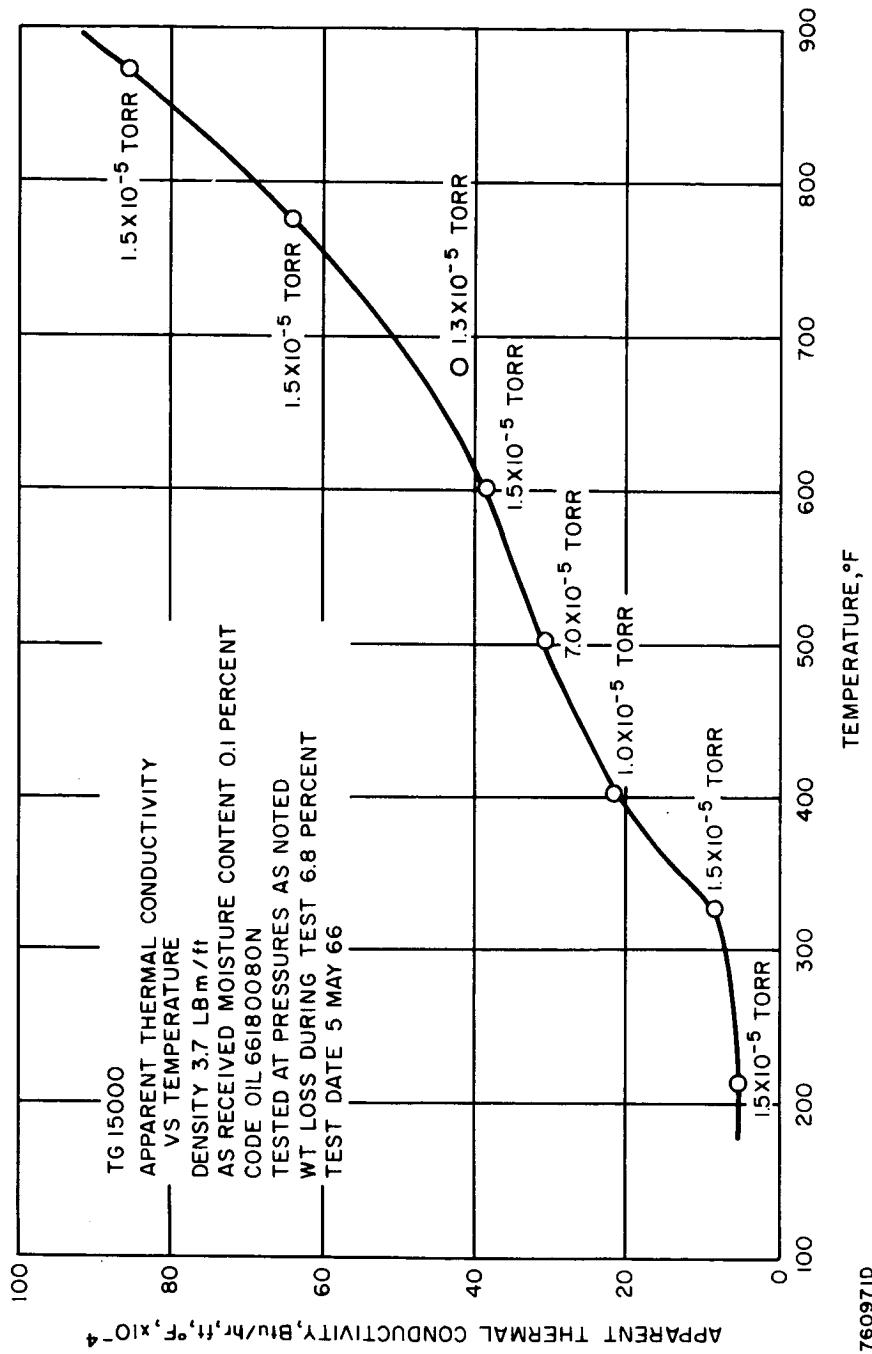


Figure 115 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE, TG15000 (VACUUM)

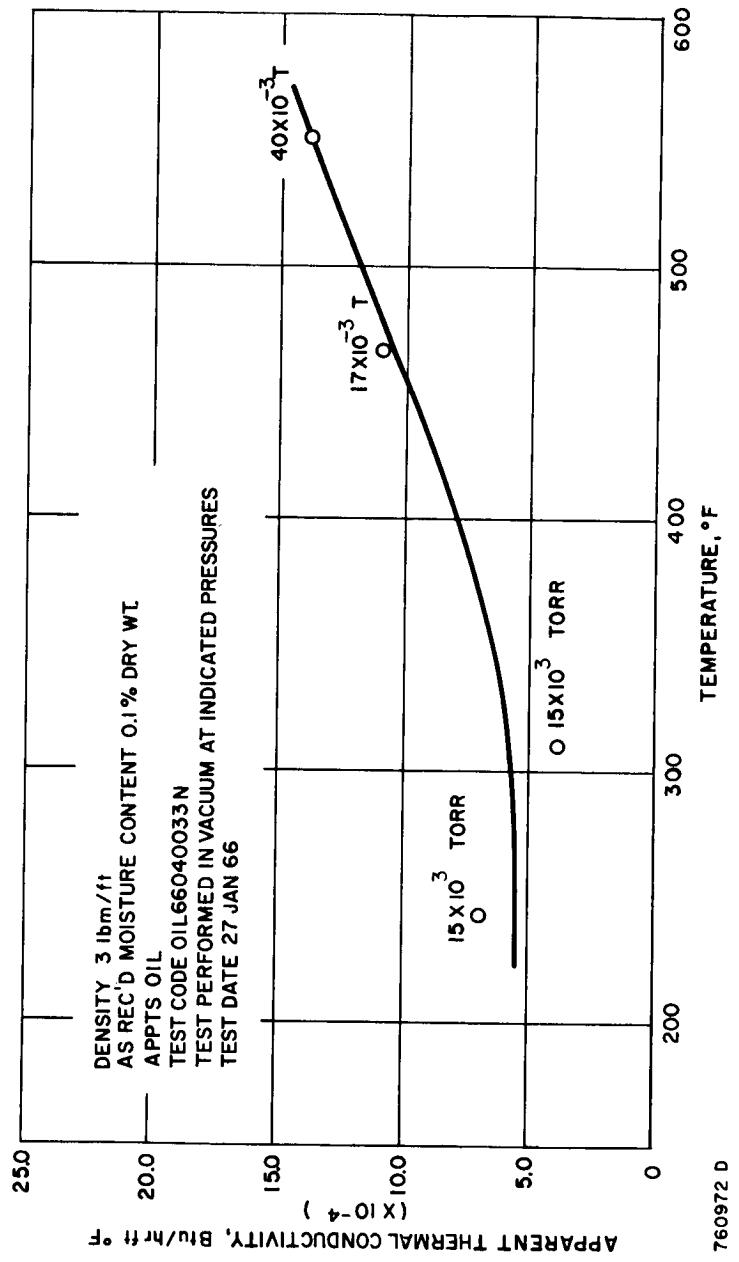


Figure 116 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE, TG15000 (VACUUM)

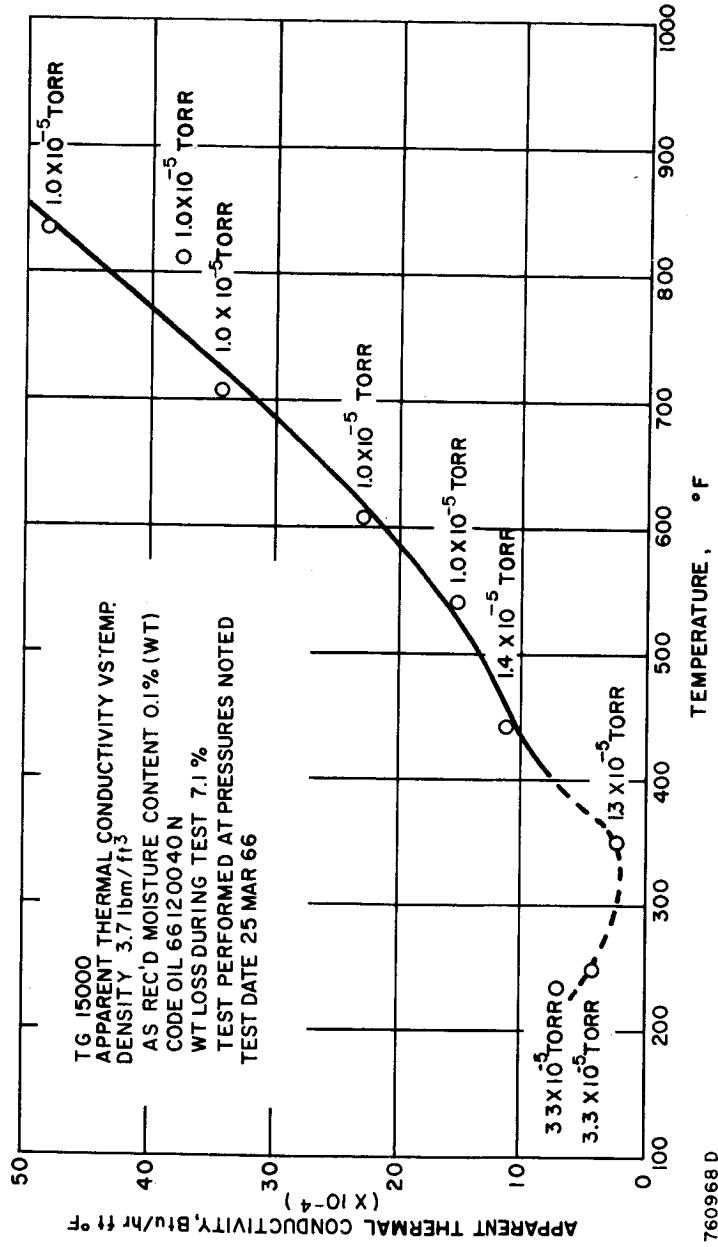


Figure 117 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE, TG15000 (VACUUM)

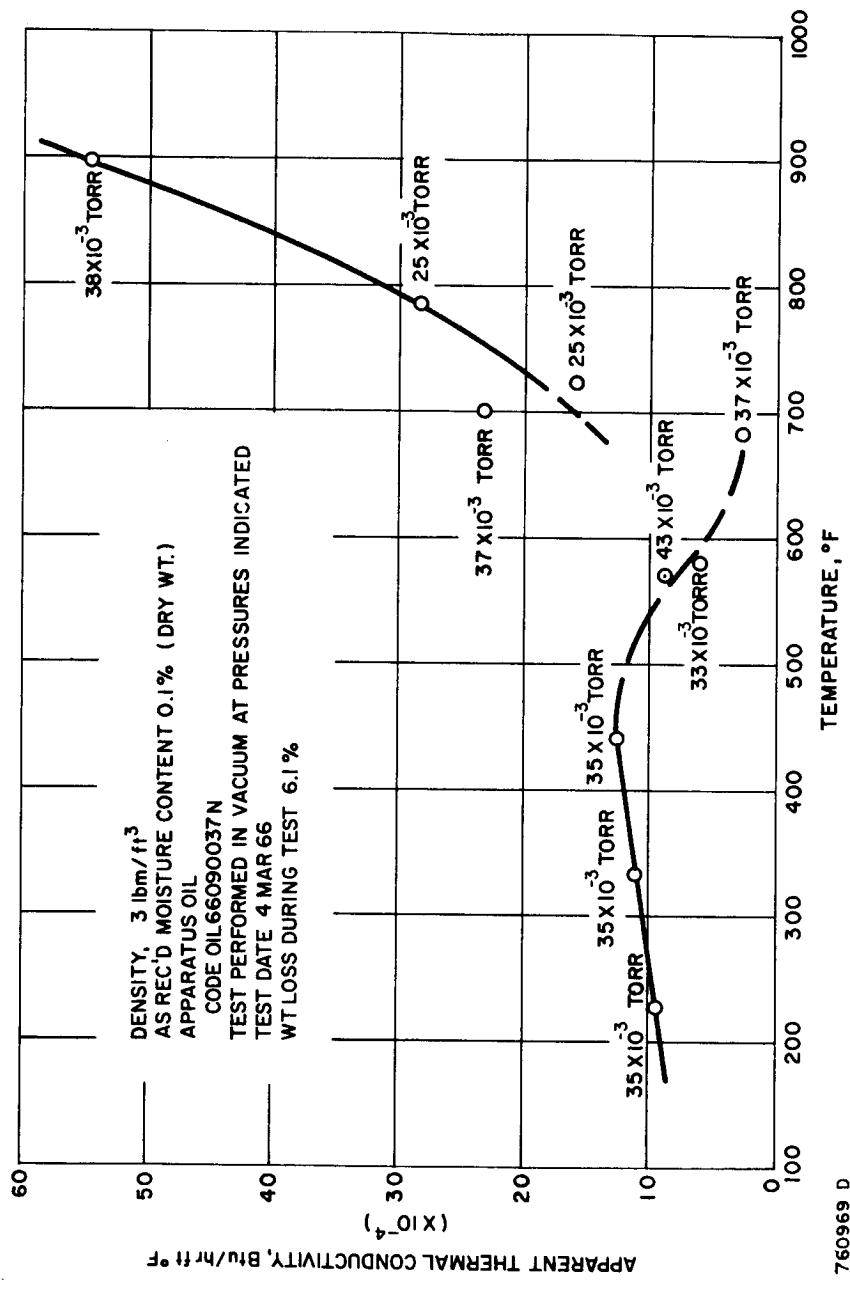


Figure 118 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE, TG15000 (VACUUM)

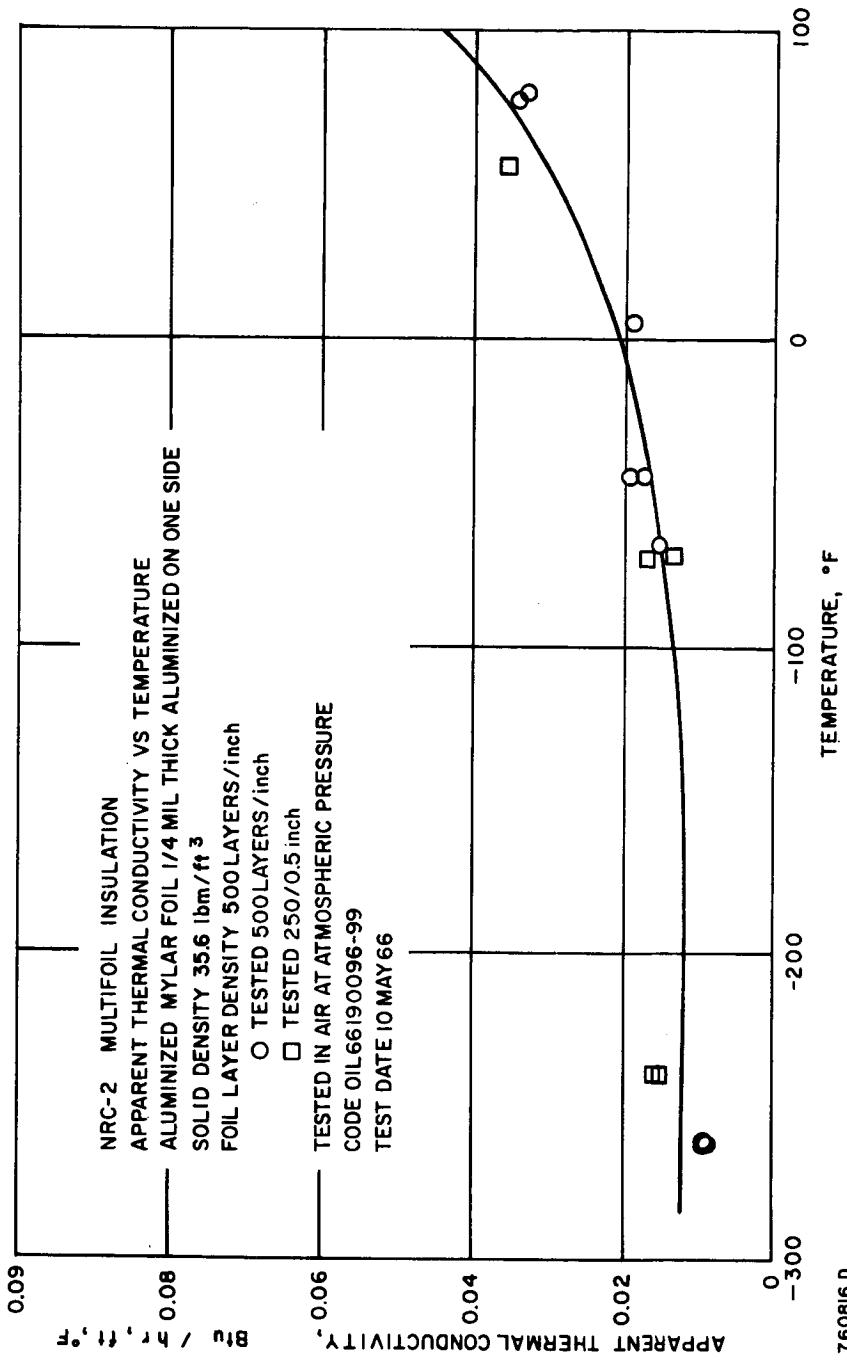


Figure 119 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE, NRC-2 (500/in.)

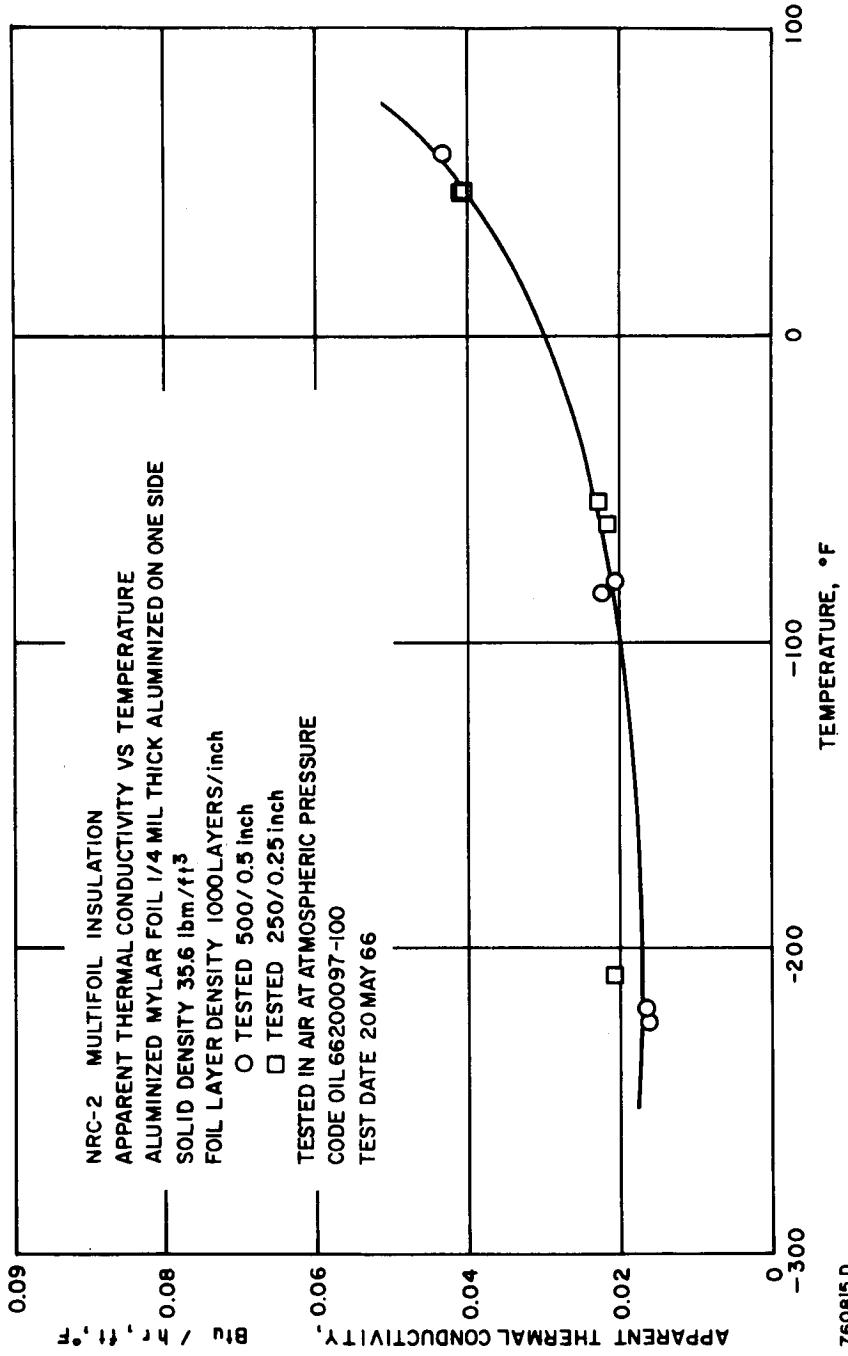


Figure 120 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE, NRC-2 (1000/in.)

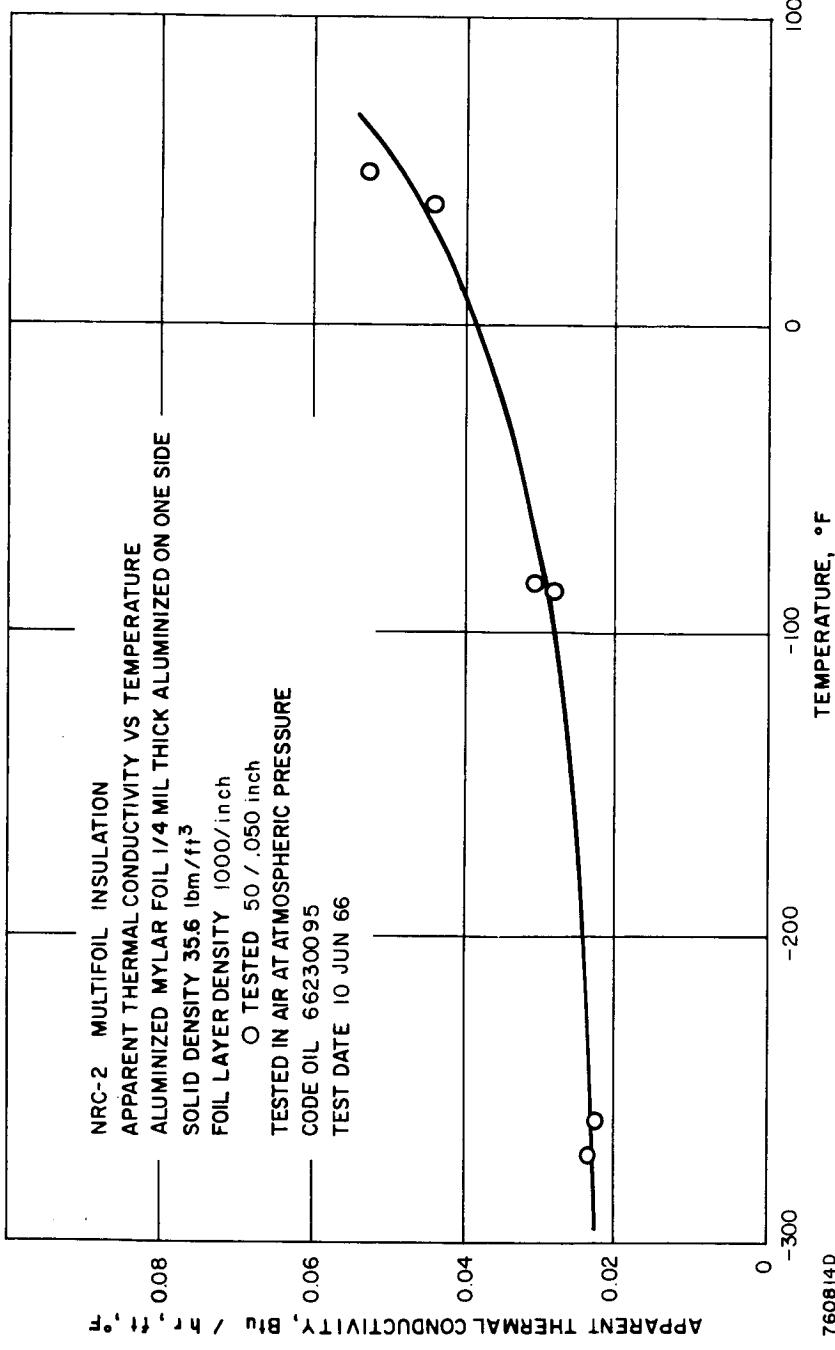


Figure 121 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE, NRC-2 (50/0.050 IN.)

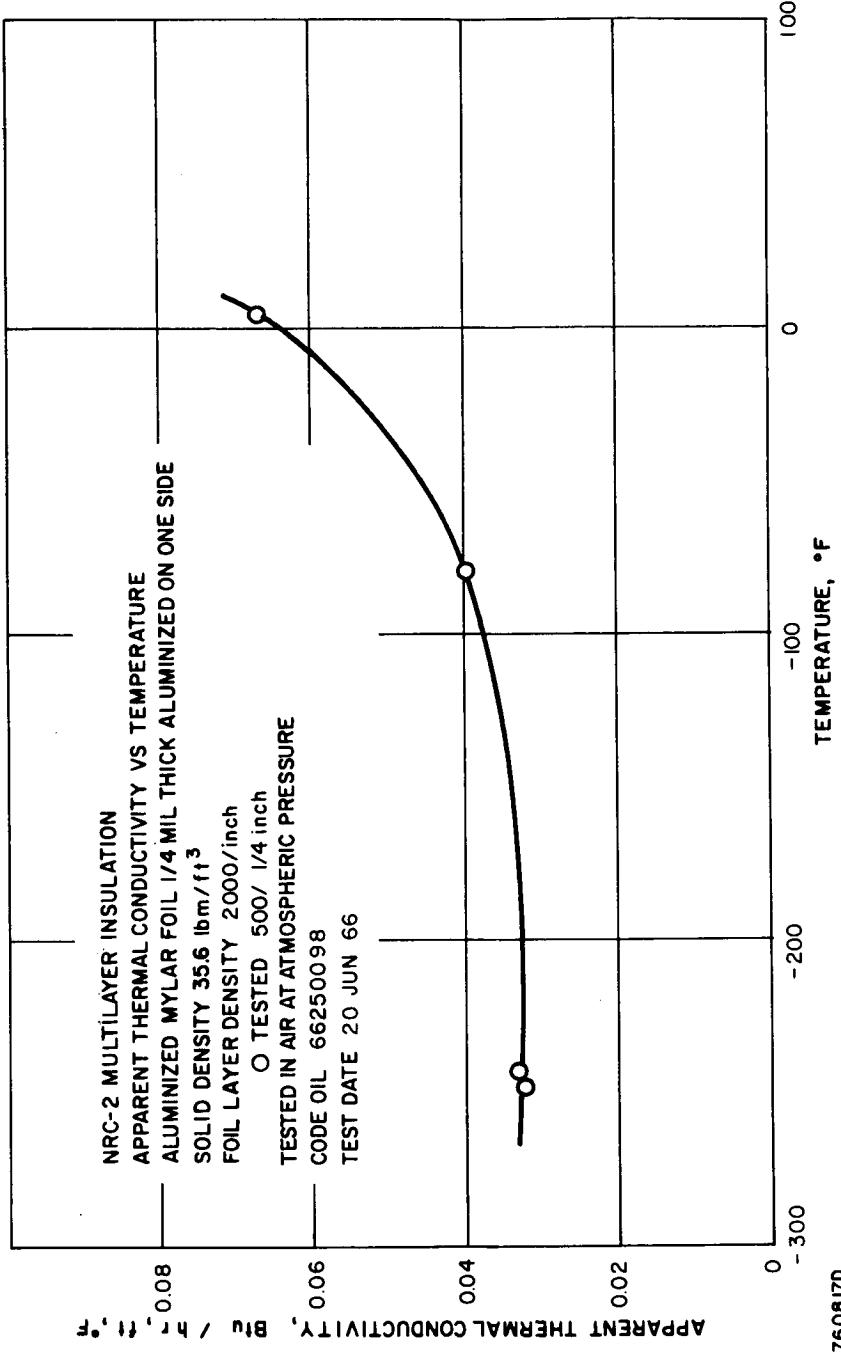


Figure 122 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE, NRC-2 (2000/IN.)

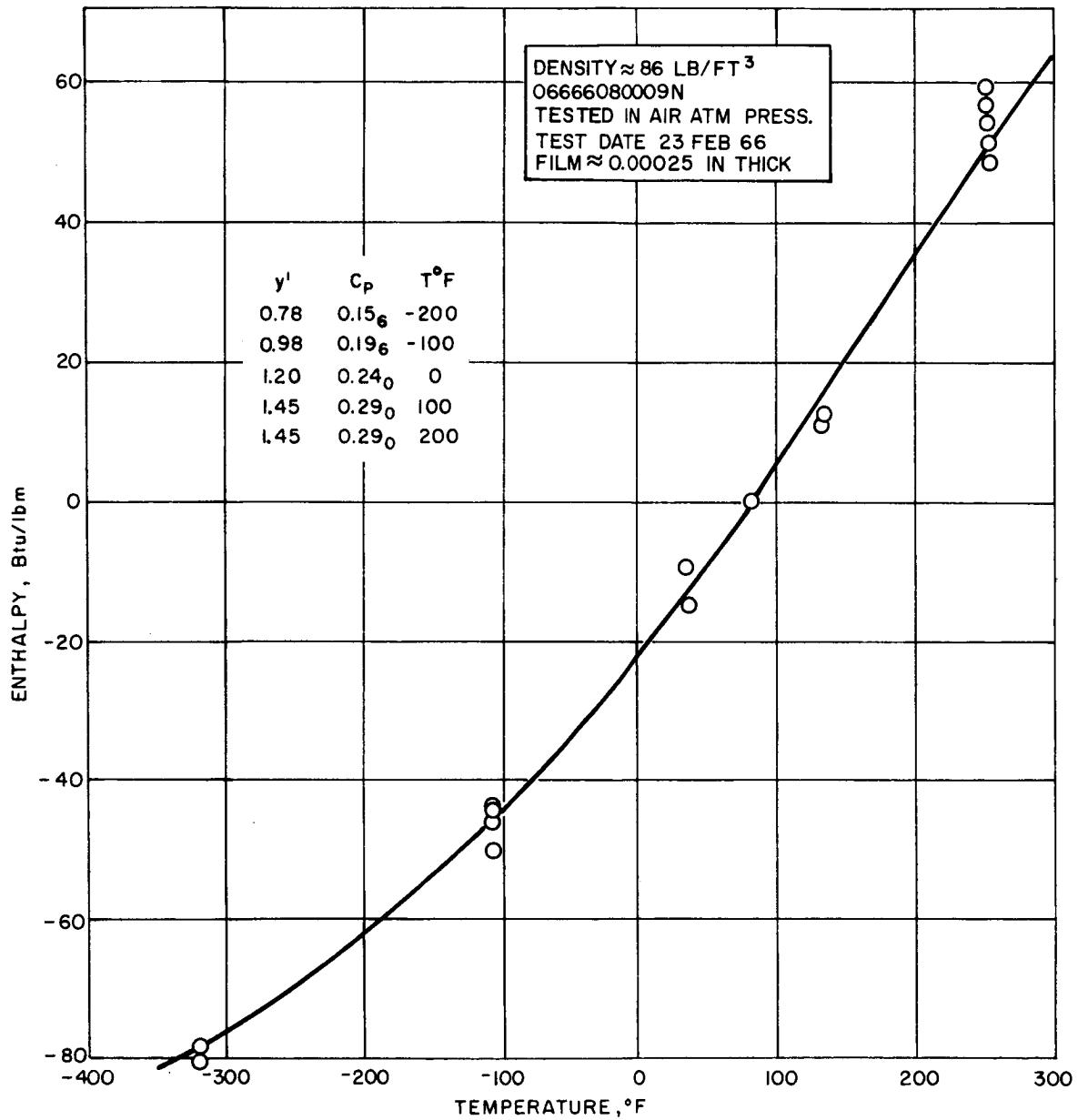


Figure 123 ENTHALPY VERSUS TEMPERATURE, NRC-2

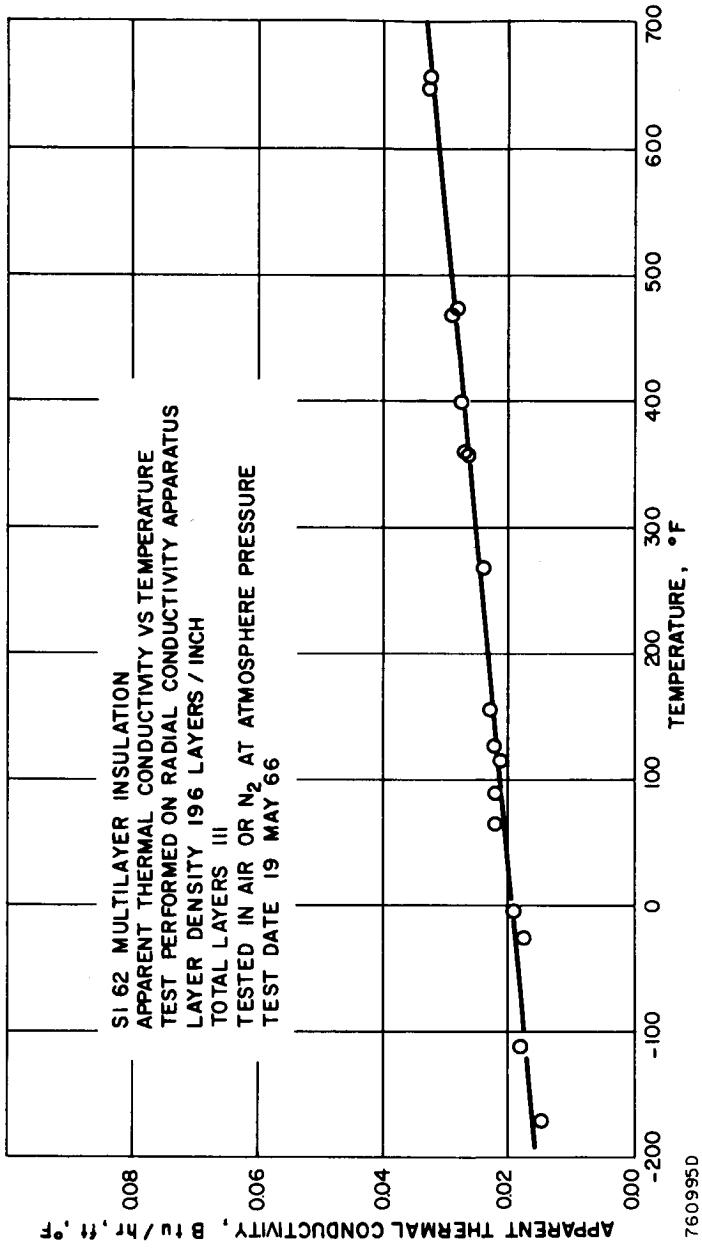


Figure 124 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE, SI 62

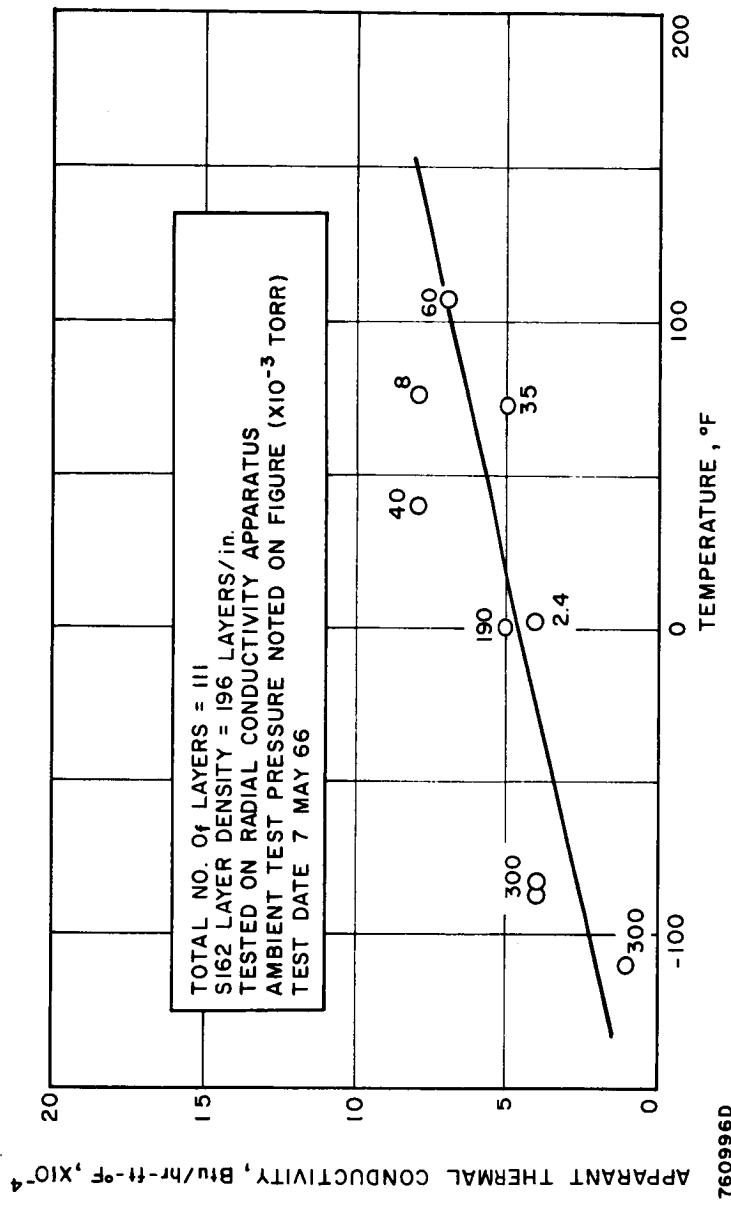


Figure 125 APPARENT THERMAL CONDUCTIVITY VERSUS TEMPERATURE, SI 62 (VACUUM)

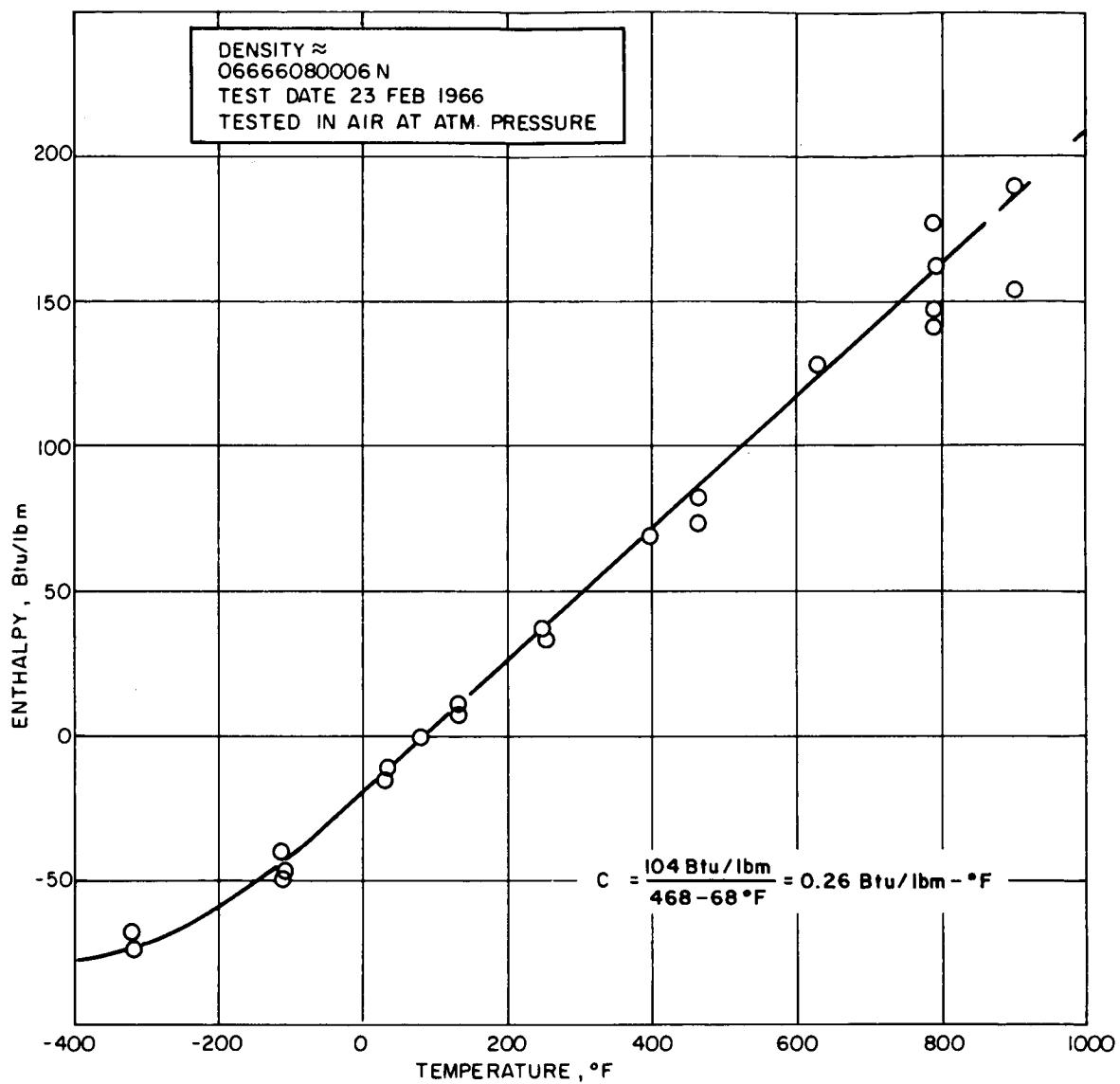


Figure 126 ENTHALPY VERSUS TEMPERATURE, SI 62

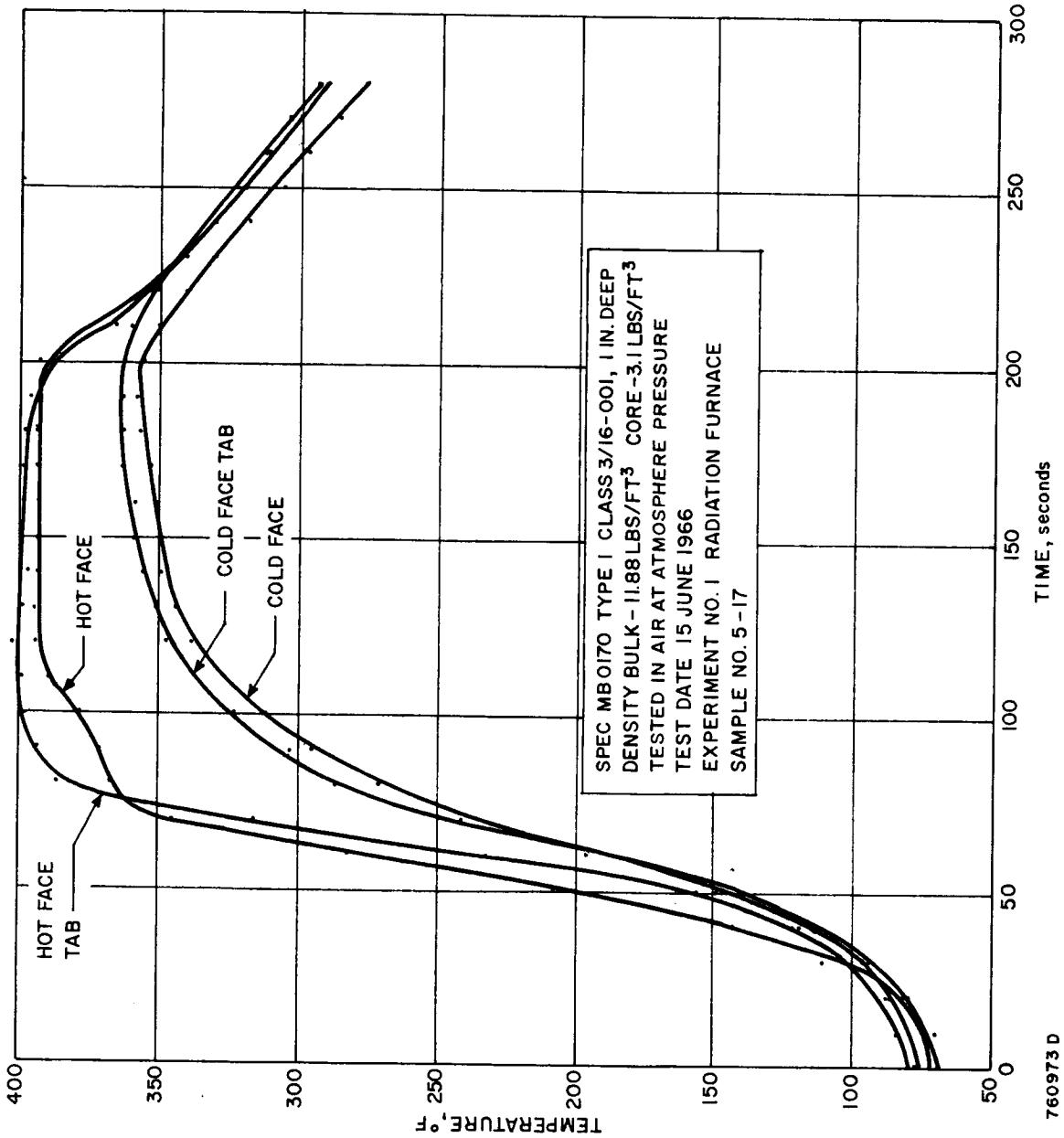


Figure 127 TRANSIENT TEMPERATURE VERSUS TIME, ALUMINUM HONEYCOMB PANEL, TEST NO. 1

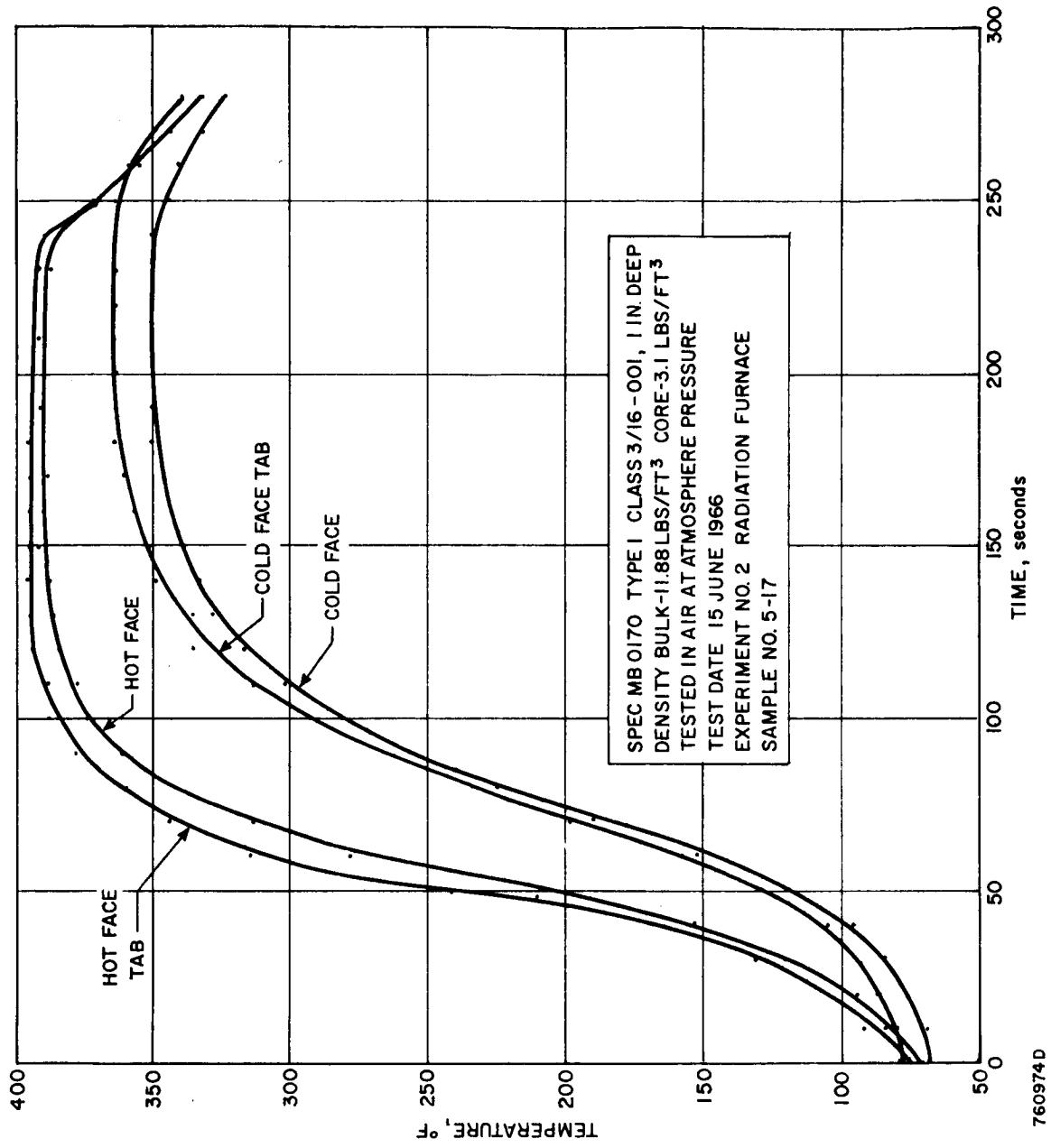


Figure 128 TRANSIENT TEMPERATURE VERSUS TIME, ALUMINUM HONEYCOMB PANEL, TEST NO. 2

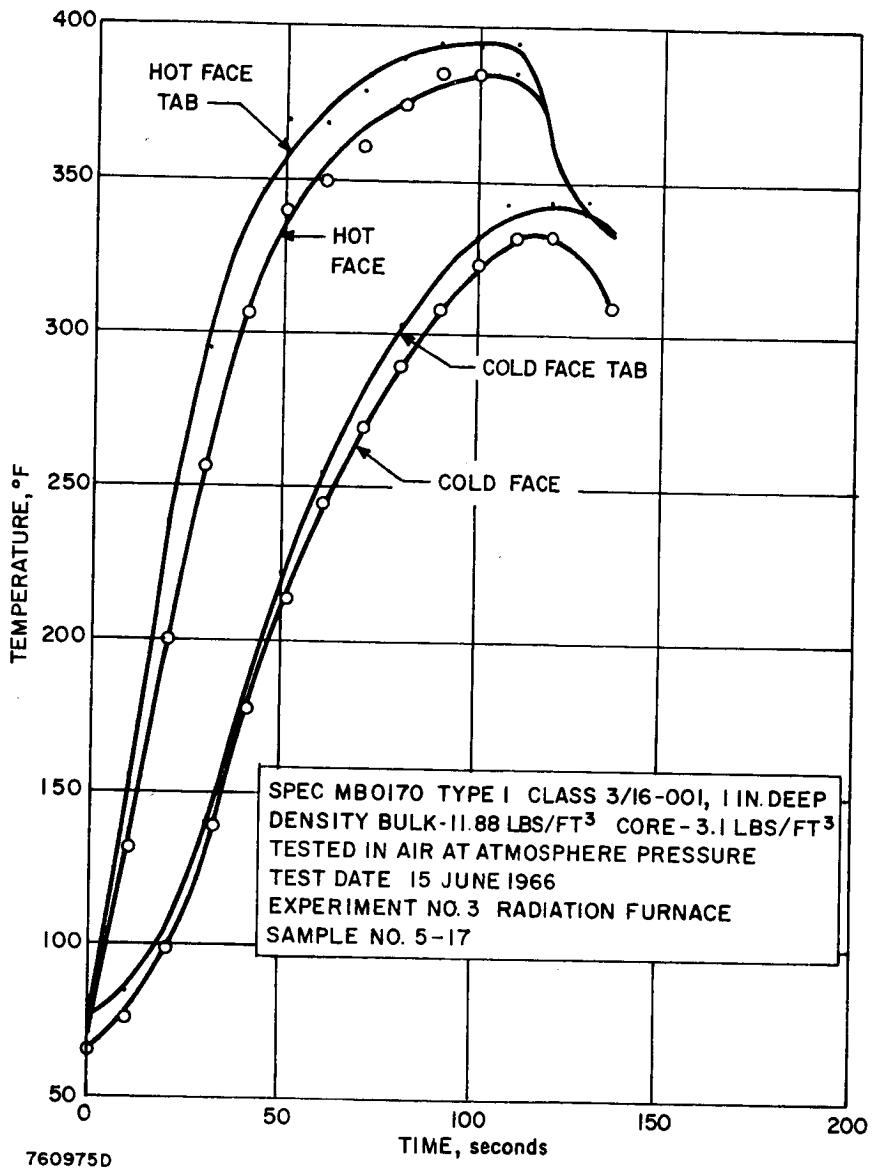


Figure 129 TRANSIENT TEMPERATURE VERSUS TIME, ALUMINUM HONEYCOMB PANEL, TEST NO. 3

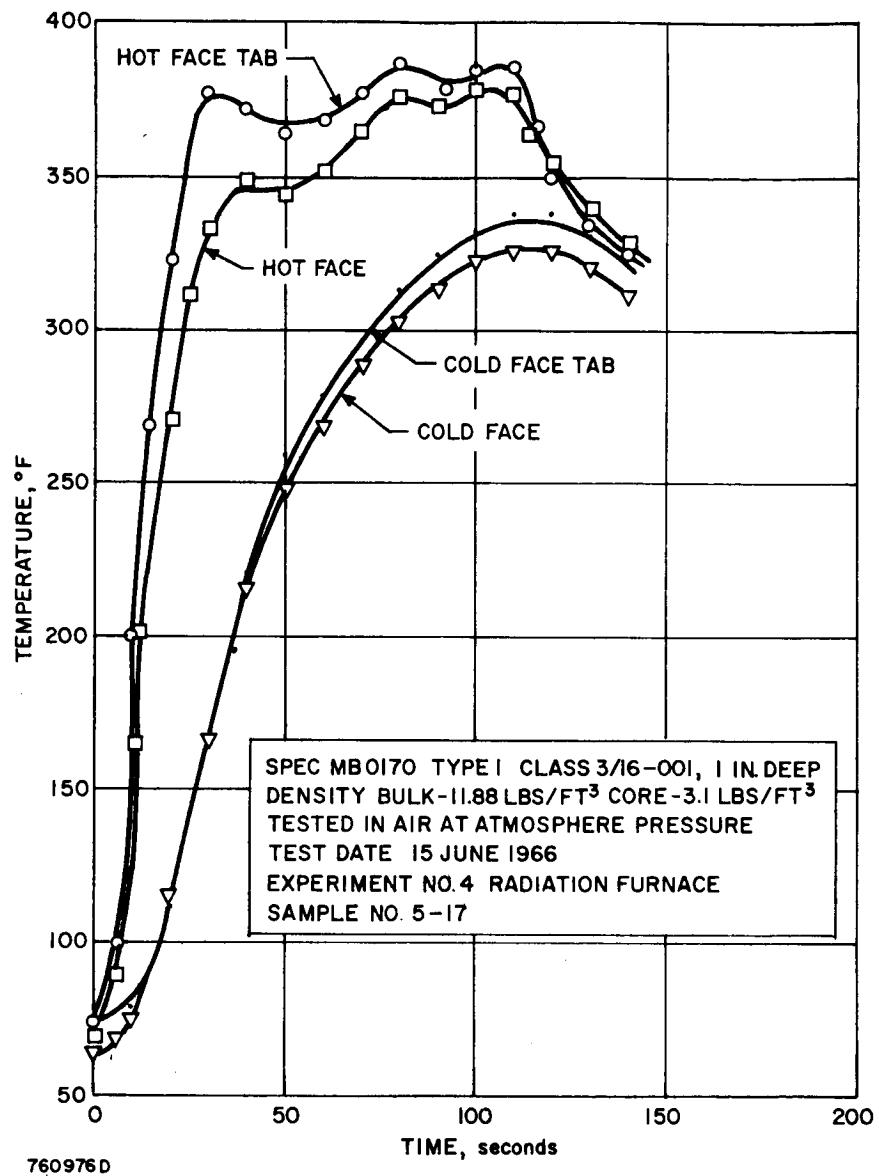


Figure 130 TRANSIENT TEMPERATURE VERSUS TIME, ALUMINUM HONEYCOMB PANEL, TEST NO. 4

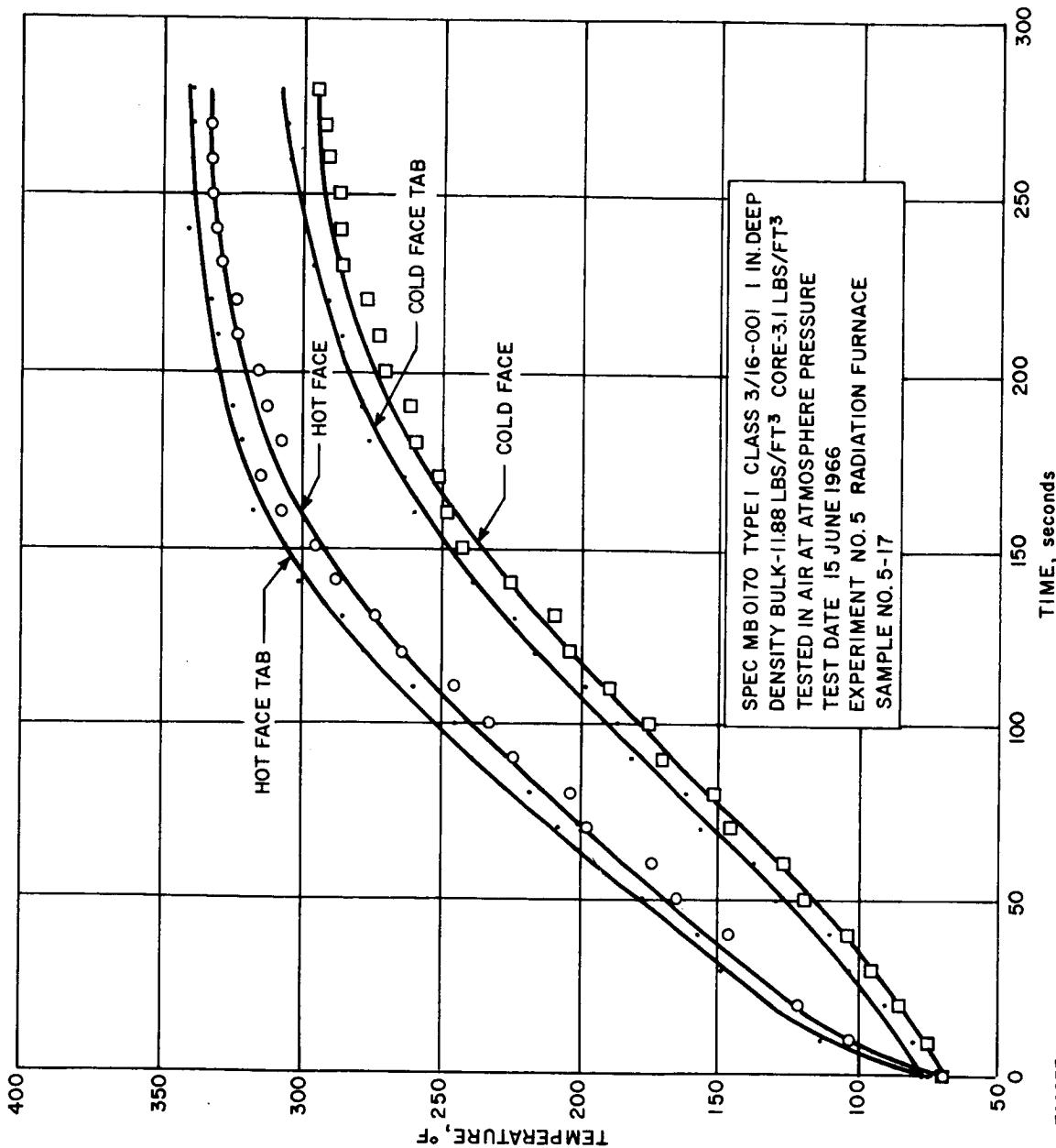


Figure 131 TRANSIENT TEMPERATURE VERSUS TIME, ALUMINUM HONEYCOMB PANEL, TEST NO. 5

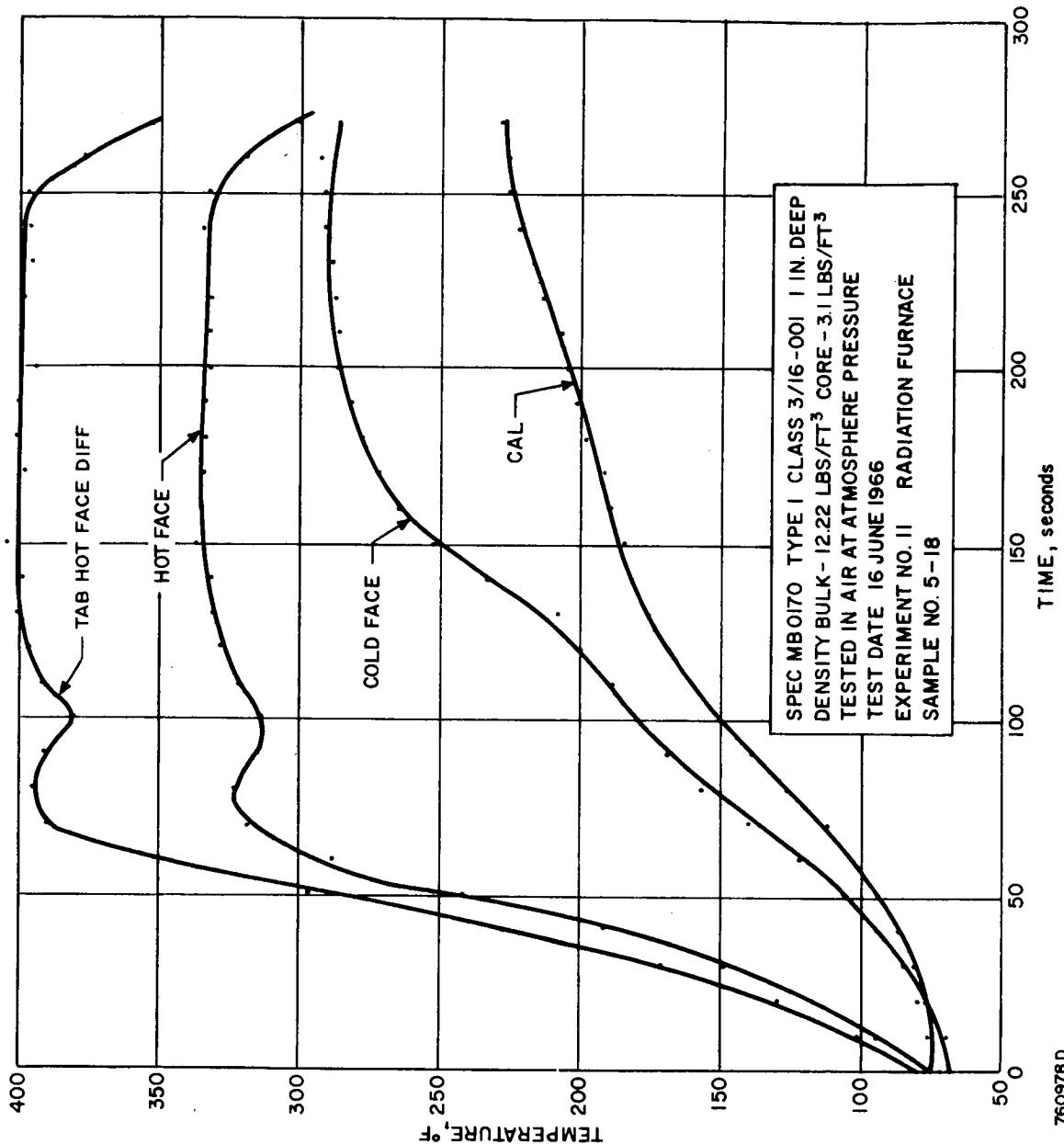


Figure 132 TRANSIENT TEMPERATURE VERSUS TIME, ALUMINUM HONEYCOMB PANEL, TEST NO. 11

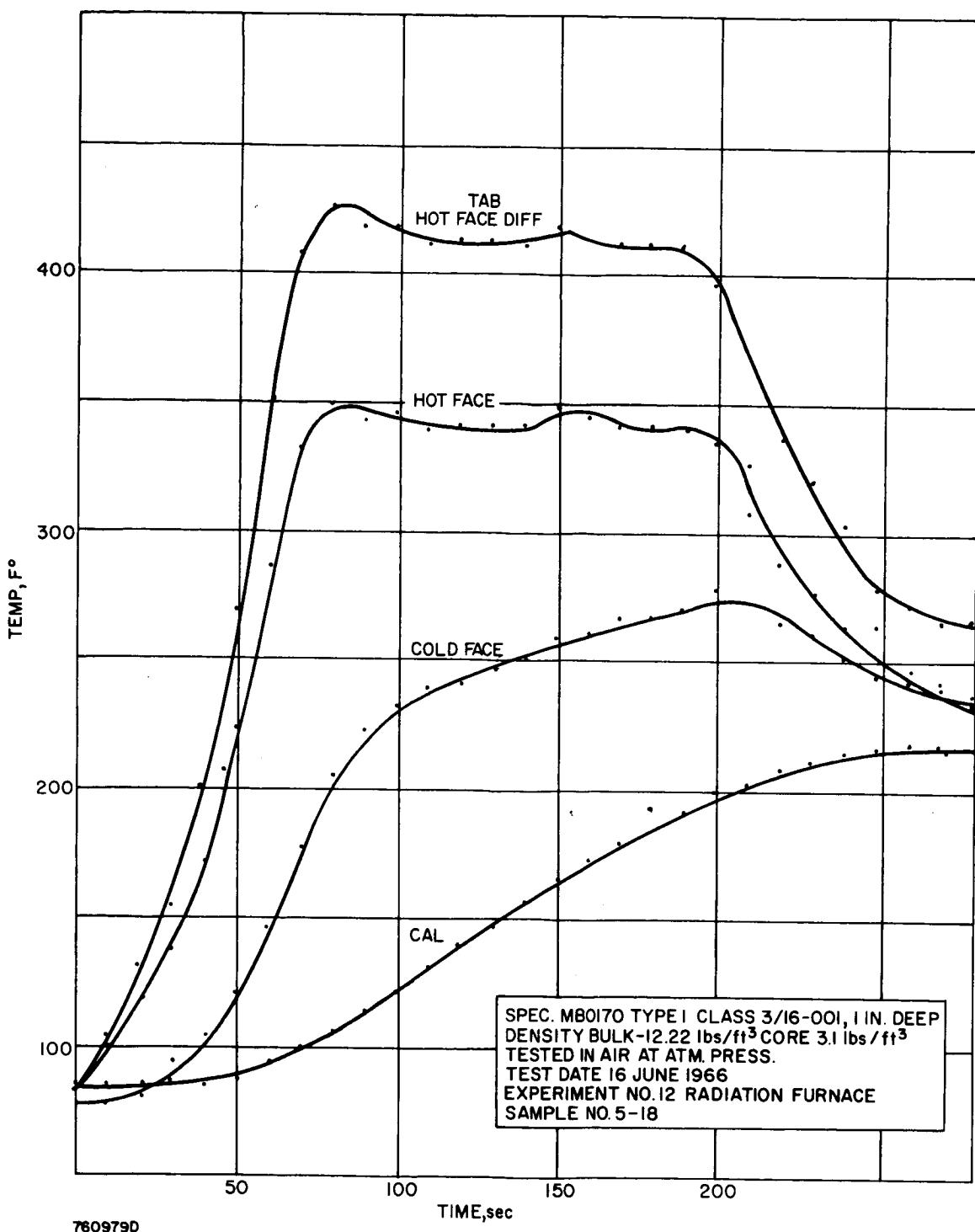


Figure 133 TRANSIENT TEMPERATURE VERSUS TIME, ALUMINUM HONEYCOMB PANEL, TEST NO. 12

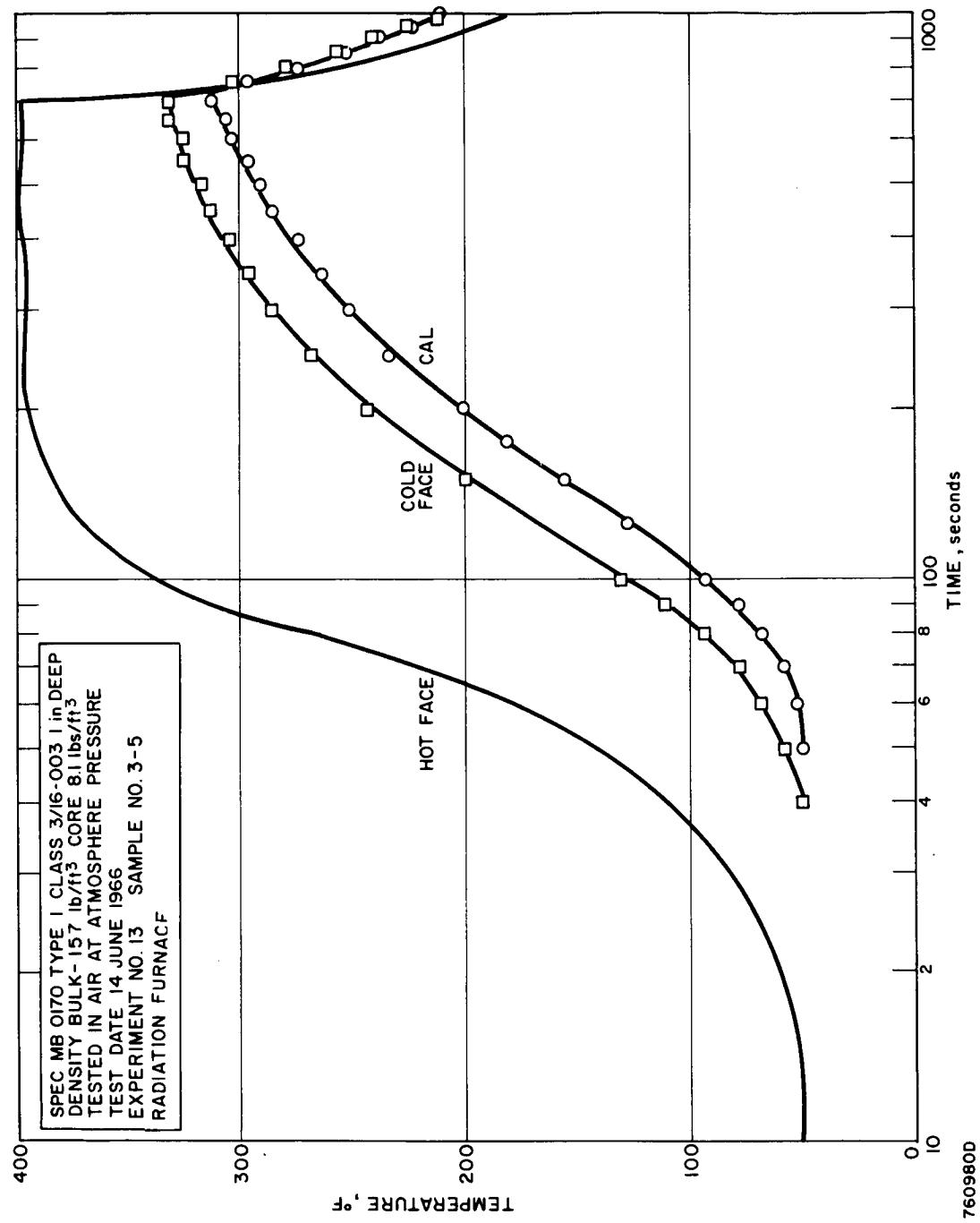


Figure 134 TRANSIENT TEMPERATURE VERSUS TIME, ALUMINUM HONEYCOMB PANEL,  
TEST NO. 13

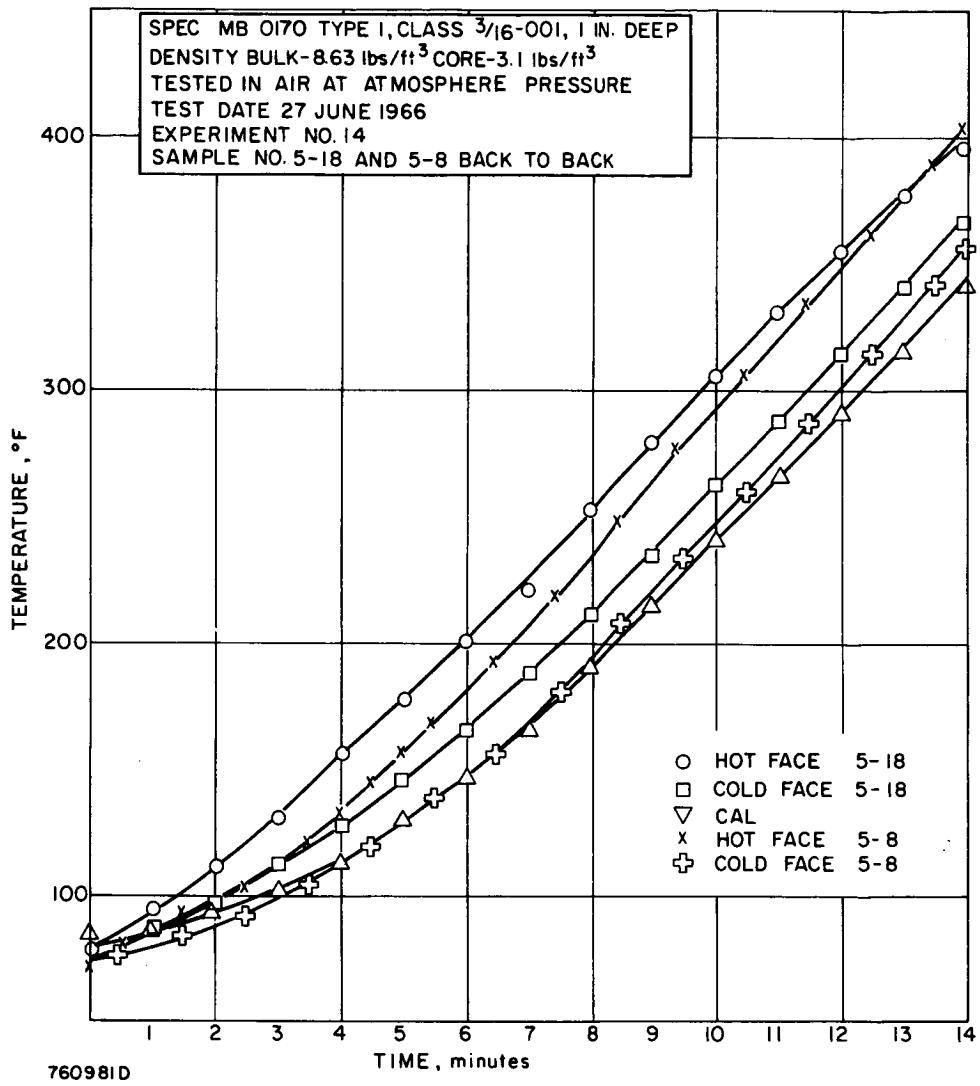


Figure 135 TRANSIENT TEMPERATURE VERSUS TIME, ALUMINUM HONEYCOMB PANEL,  
TEST NO. 14

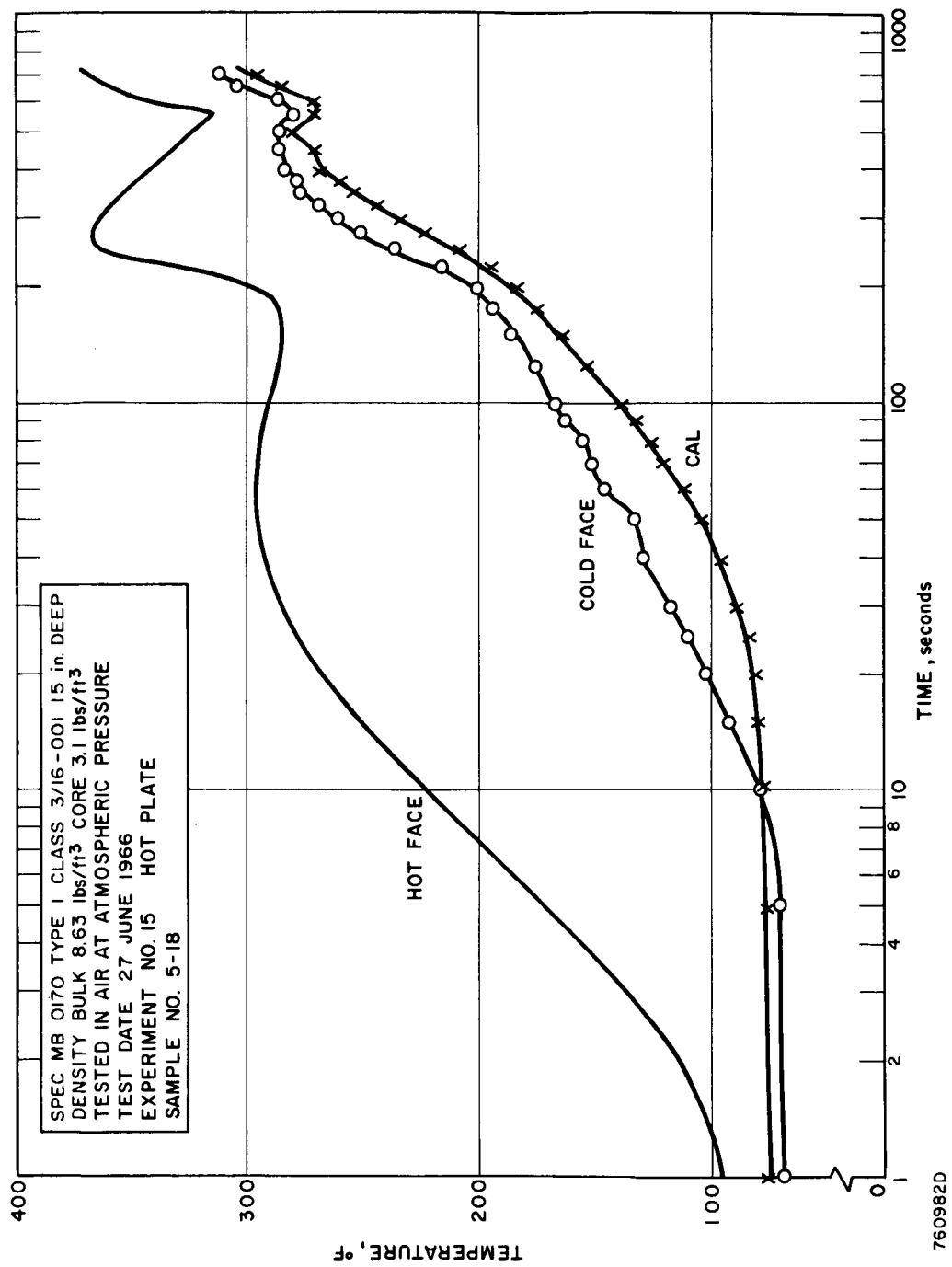


Figure 136 TRANSIENT TEMPERATURE VERSUS TIME, ALUMINUM HONEYCOMB PANEL,  
TEST NO. 15

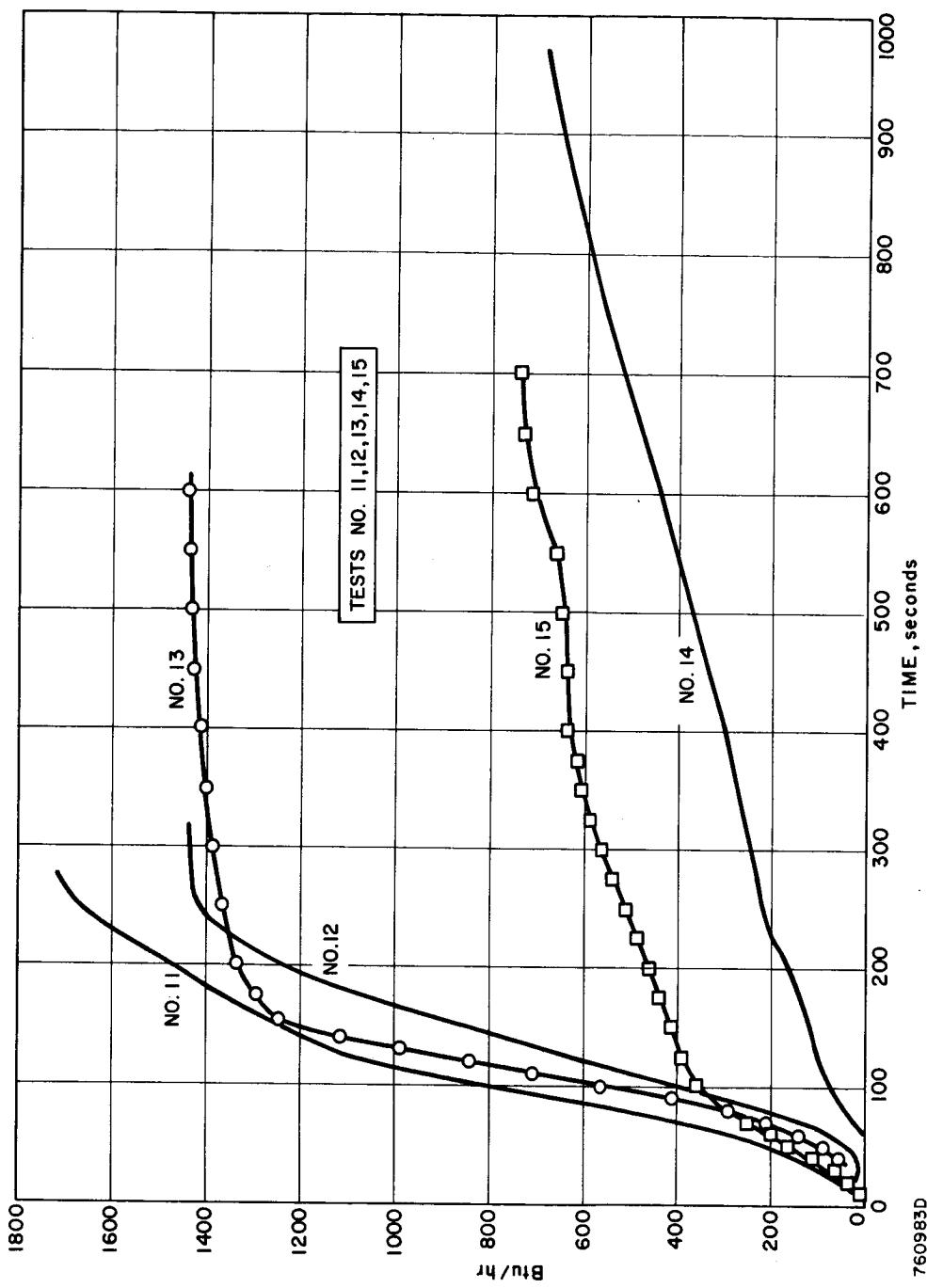


Figure 137 TRANSIENT TEST, CALORIMETER PERFORMANCE, TESTS 11 THROUGH 15

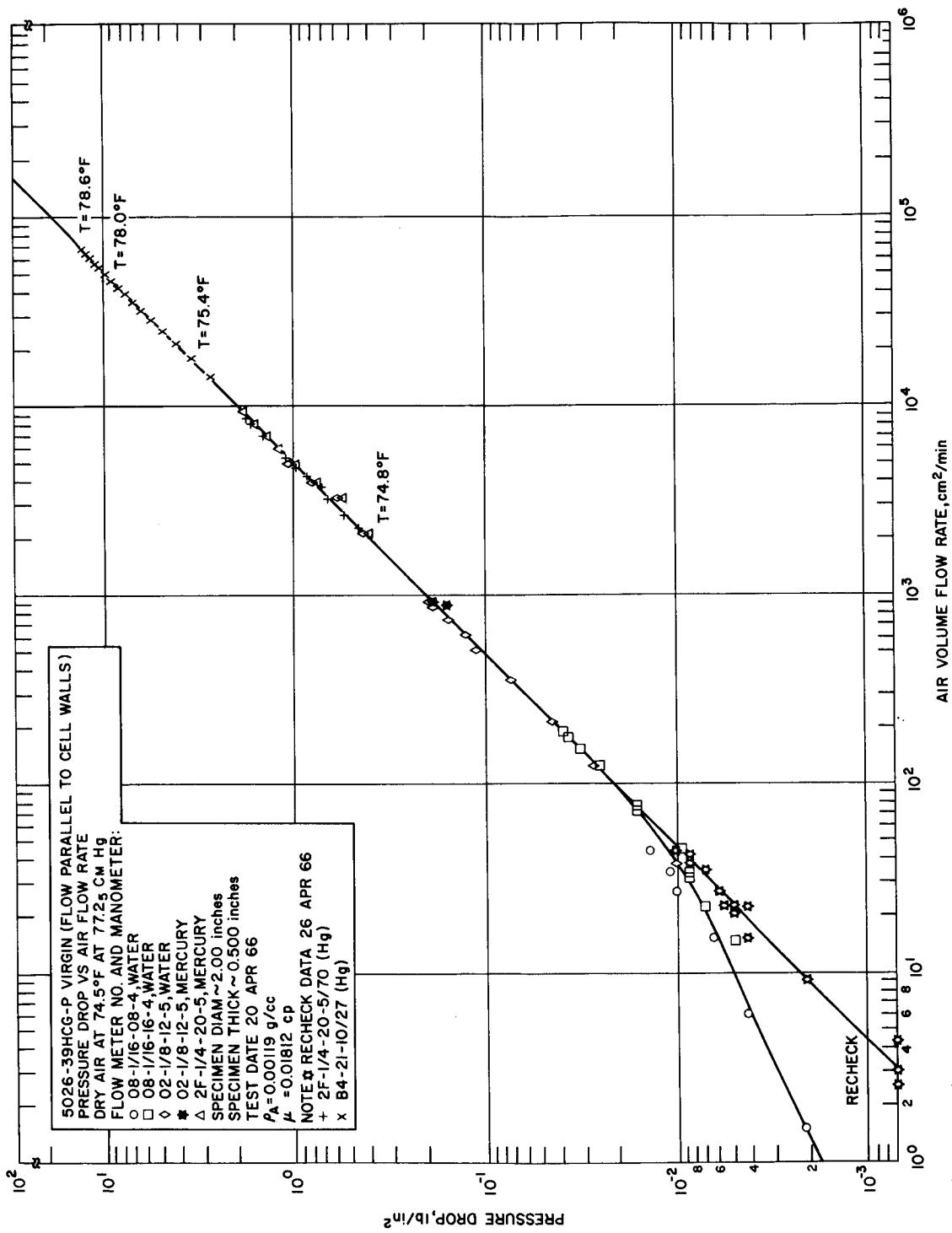


Figure 138 PRESSURE DROP VERSUS VOLUME AIR FLOW RATE, VIRGIN ABLATOR,  
AVCOAT 5026-39 PARALLEL TO CELLS

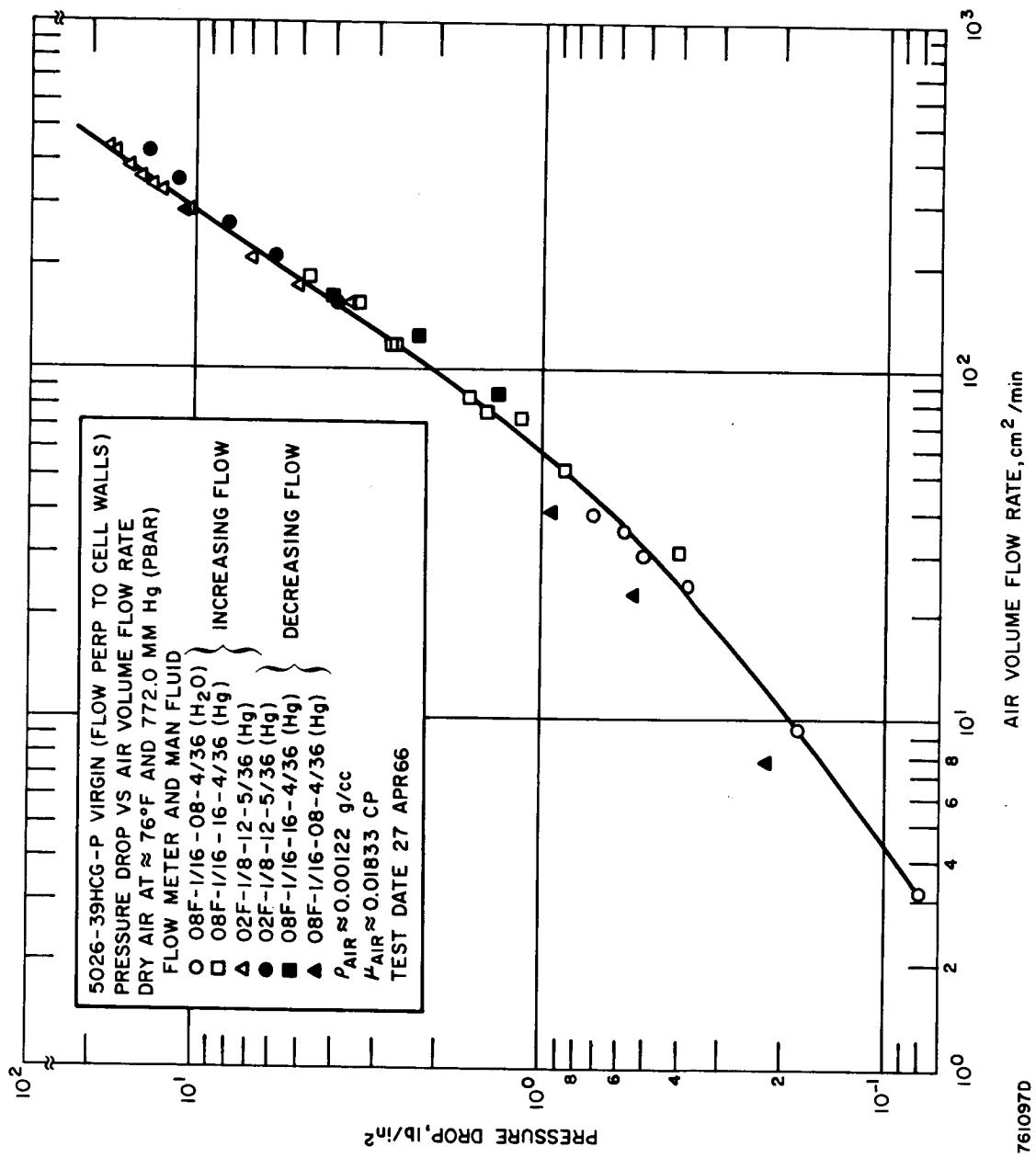


Figure 139 PRESSURE DROP VERSUS VOLUME AIR FLOW RATE, VIRGIN ABLATOR,  
AVCOAT 5026-39 PERPENDICULAR TO CELLS

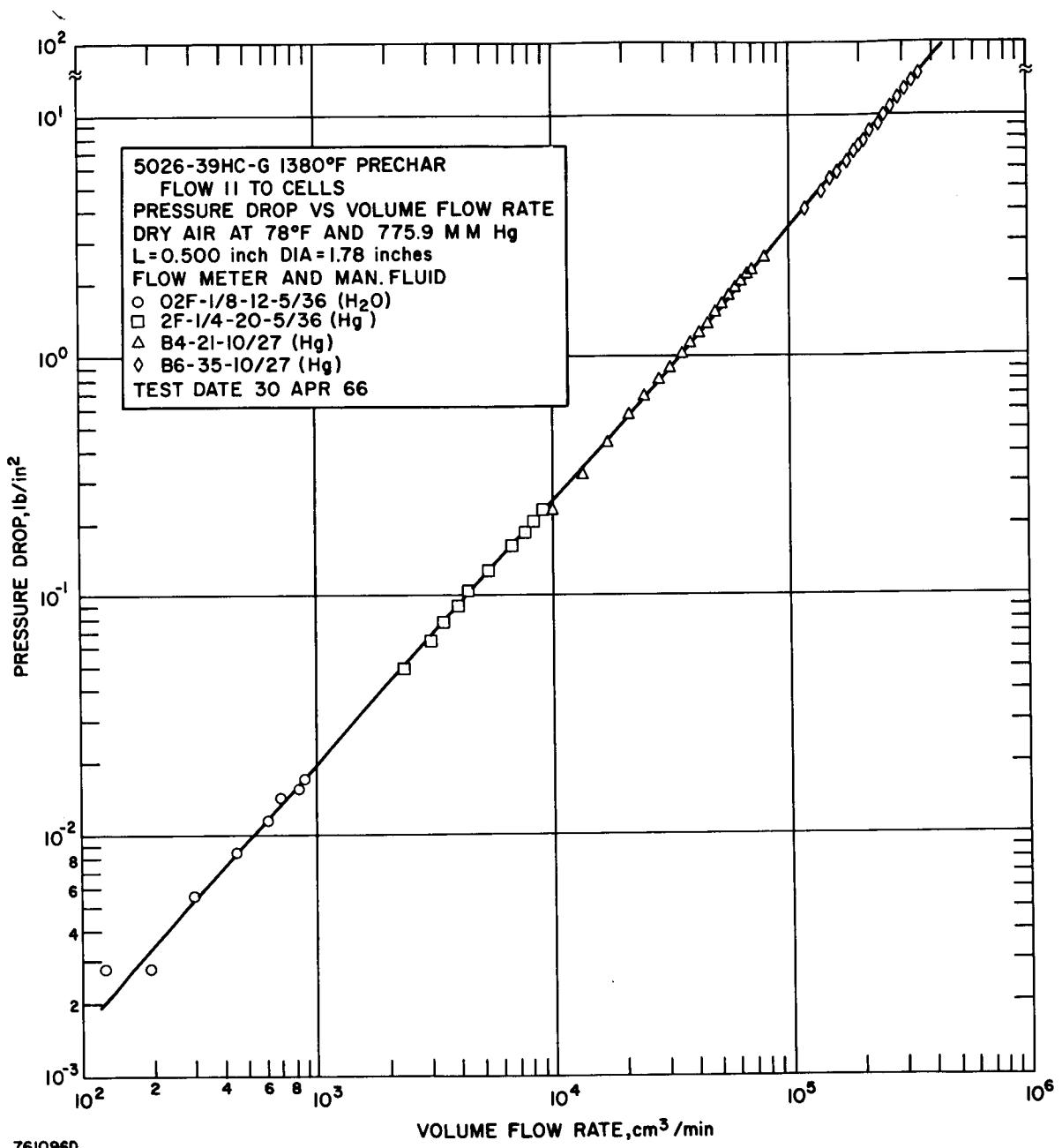


Figure 140 PRESSURE DROP VERSUS VOLUME AIR FLOW RATE, CHARRED ABLATOR, AVCOAT 5026-39 PARALLEL TO CELLS

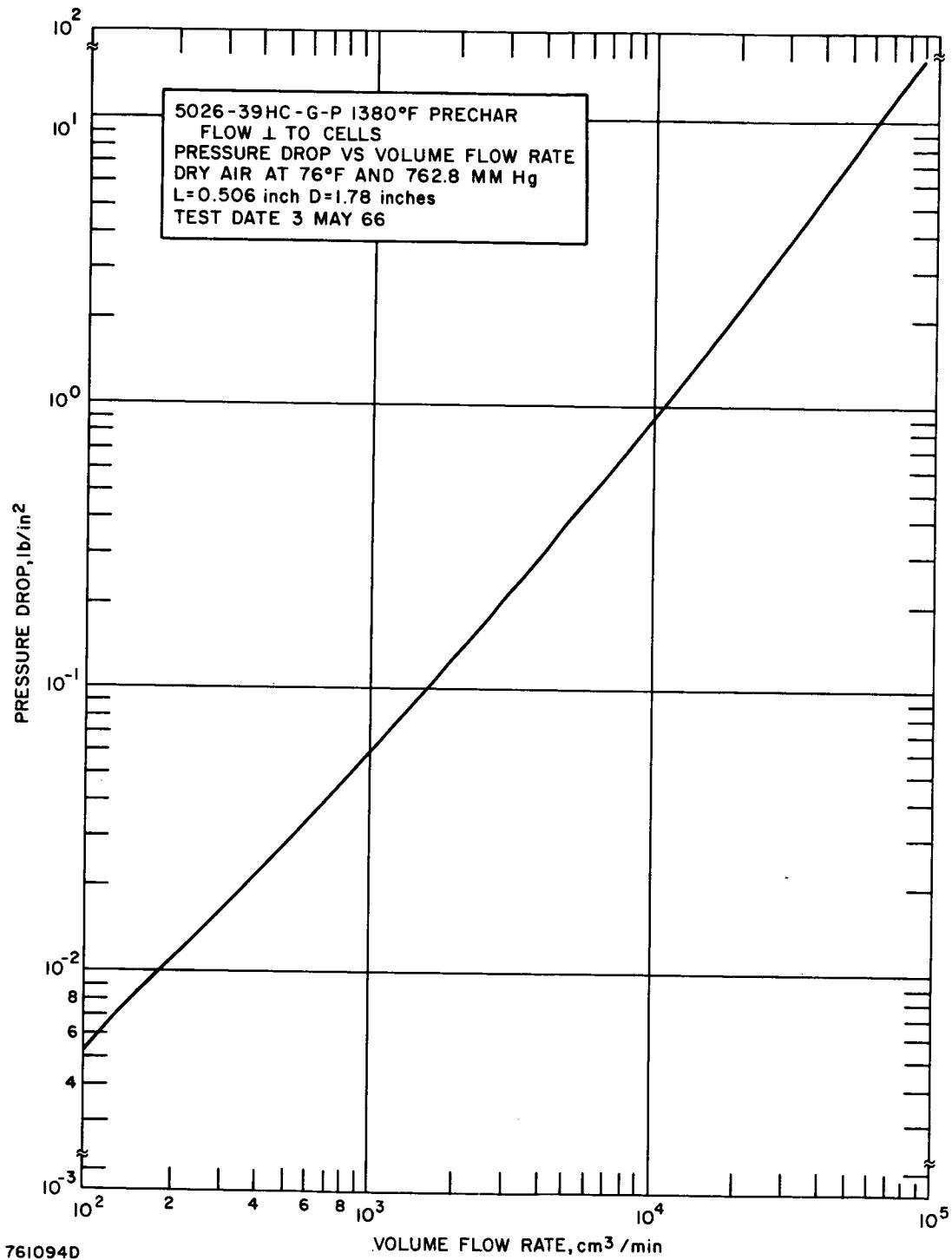


Figure 141 PRESSURE DROP VERSUS VOLUME AIR FLOW RATE, CHARRED ABLATOR,  
AVCOAT 5026-39 PERPENDICULAR TO CELLS

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TABLE I

ARITHMETIC MEAN AND STANDARD DEVIATION OF ALUMINUM HONEYCOMB PANEL DATA:  
APPARENT THERMAL CONDUCTIVITY

Cell and Nom Foil Size (In.)	Conductivity (K)								
	-250°F	-100°F	0°F	100°F	200°F	300°F	400°F	500°F	600°F
<u>1/4, 0.001</u> Std Dev ± 0.15	0.69	0.81	0.89	0.97	1.05	1.13	1.21	1.29	1.37
<u>3/16, 0.001</u> Std Dev ± 0.30	0.77	0.98	1.12	1.26	1.40	1.54	1.68	1.82	1.96
<u>1/8, 0.001</u> Std Dev ± 0.36	1.22	1.37	1.48	1.58	1.69	1.79	1.90	2.00	2.11
<u>1/4, 0.0015</u> Std Dev ± 0.38	0.79	0.96	1.07	1.18	1.29	1.40	1.52	1.63	1.74
<u>3/16, 0.0015</u> Std Dev ±	1.31	1.45	1.54	1.64	1.73	1.82	1.91	2.00	2.10
<u>1/8, 0.0015</u> Std Dev ± 0.21	1.43	1.68	1.85	1.92	2.27	2.35	2.52	2.69	2.86
<u>1/4, 0.003</u> Std Dev ± 0.45	1.36	1.58	1.73	1.88	2.03	2.17	2.32	2.47	2.62
<u>3/16, 0.003</u> Std Dev ± 0.78	2.46	2.46	2.46	2.46	2.46	2.46	2.46	2.46	2.46
<u>1/8, 0.003</u> Std Dev ± 1.08	2.31	2.71	2.97	3.23	3.49	3.75	4.01	4.27	4.54
<u>3/16, 0.0015 (NAA)</u> Std Dev ± 0.11	0.78	0.94	1.05	1.16	1.26	1.37	1.48	1.59	1.70
<u>1/8, 0.001</u> Std Dev ± 0.03					1.66	1.90	2.14	2.37	2.60
<u>1/8, 0.003</u> Std Dev ± 0.08					4.42	4.48	4.54	4.60	4.65
<u>3/16, 0.001</u> Std Dev ± 0.08					0.72	1.07	1.42	1.76	2.11
<u>3/16, 0.003</u> Std Dev ± 0.04					2.74	2.89	3.04	3.18	3.33
<u>1/4, 0.001</u> Std Dev ± 0.10					0.21	0.29	0.38	0.47	0.55
<u>1/4, 0.003</u> Std Dev ± 0.10					2.05	2.21	2.38	2.54	2.70

TABLE II

FIRST-ORDER EQUATIONS OF ALUMINUM HONEYCOMB PANEL DATA:  
APPARENT THERMAL CONDUCTIVITY

Cell and Nominal Foil Size (In.)	Conductivity	Standard Deviation
1/4, 0.001	$0.89 + 7.9 \times 10^{-4} T$	$\pm 0.15$
3/16, 0.001	$1.12 + 1.39 \times 10^{-3} T$	$\pm 0.30$
1/8, 0.001	$1.48 + 1.05 \times 10^{-3} T$	$\pm 0.36$
1/4, 0.0015	$1.07 + 1.12 \times 10^{-3} T$	$\pm 0.38$
3/16, 0.0015	$1.54 + 9.24 \times 10^{-4} T$	$\pm 0.38$
1/8, 0.0015	$1.85 + 1.68 \times 10^{-3} T$	$\pm 0.21$
1/4, 0.003	$1.73 + 1.48 \times 10^{-3} T$	$\pm 0.45$
3/16, 0.003	$2.46 - 1.69 \times 10^{-8} T$	$\pm 0.78$
1/8, 0.003	$2.97 + 2.61 \times 10^{-3} T$	$\pm 1.08$
3/16, 0.0015 (NAA)	$1.05 + 1.08 \times 10^{-3} T$	$\pm 0.11$
1/8, 0.001 Vacuum $200 < T < 600^{\circ}\text{F}$	$1.19 + 2.35 \times 10^{-3} T$	$\pm 0.03$
1/8, 0.003 Vacuum $200 < T < 600^{\circ}\text{F}$	$4.31 + 5.70 \times 10^{-4} T$	$\pm 0.08$
3/16, 0.001 Vacuum $200 < T < 600^{\circ}\text{F}$	$1.85 \times 10^{-2} + 3.49 \times 10^{-3} T$	$\pm 0.08$
3/16, 0.003 Vacuum $200 < T < 600^{\circ}\text{F}$	$2.44 + 1.49 \times 10^{-3} T$	$\pm 0.04$
1/4, 0.001 Vacuum $200 < T < 600^{\circ}\text{F}$	$3.20 \times 10^{-2} + 8.70 \times 10^{-4} T$	$\pm 0.10$
1/4, 0.003 Vacuum $200 < T < 600^{\circ}\text{F}$	$1.73 + 1.62 \times 10^{-3} T$	$\pm 0.10$

TABLE III  
 ARITHMETIC MEAN AND STANDARD DEVIATION OF STAINLESS STEEL HONEYCOMB PANEL DATA:  
 APPARENT THERMAL CONDUCTIVITY

Temperature (°F)	-250	-100	0	100	200	300	400	500	600
SST H/C									
Std Dev $\pm$ 0.015	0.113	0.154	0.181	0.208	0.235	0.262	0.289	0.316	0.343

TABLE IV  
 FIRST ORDER EQUATION OF STAINLESS STEEL  
 HONEYCOMB PANEL DATA

Conductivity	Standard Deviation
$0.181 + 2.71 \times 10^{-4} T$	$\pm 0.015$

TABLE V  
TABULATION OF 5026-39 DATA: THERMAL CONDUCTIVITY AT SELECTED TEMPERATURES

Test No.	Density (lb/ft <sup>3</sup> )	-250°F	-100°F	250°F	600°F	1000°F	Remarks
1	28.6			0.043			
2	30.4			0.047			
3	29.0	0.030	0.041	0.056	0.062		
4	31.2	0.033	0.046	0.058	0.060		
5	30.9			0.048	0.057		
6	29.5			0.046	0.057		
7	30.6			0.045	0.062		
8	31.0			0.058	0.064		
9	30.5			0.048	0.066		
10	29.8			0.053	0.064		
11	31.0			0.060	0.063		
12	30.0			0.050	0.061		
13	29.5			0.053	0.062		
14	30.3			0.057	0.064		
15	29.8			0.056	0.057		
16	29.2			0.055	0.056		
17	19.7	0.020	0.030	0.046		0.049	1000°F Char
18	17.6			0.044			1000°F Char
19	17.6	0.018	0.030	0.045		0.047	1000°F Char
20	19.9	0.033	0.058	0.098		0.123	1750°F Char
21	19.7	0.028	0.055	0.099		0.090	1750°F Char
22	33.8			0.057	0.059		
23	30.3			0.058	0.063		
24	32.0			0.056	0.061		
25	29.7	0.028	0.042		0.052		
26	31.0	0.033	0.042	0.054	0.060		
27	28.0	0.020	0.040	0.052	0.063		
28	30.9	0.027	0.040	0.056	0.060		
29	28.8	0.029	0.040	0.054	0.060		
30	17.6	0.016	0.026	0.040		0.035	1000°F Char
31	17.8	0.016	0.025	0.040		0.037	1000°F Char
32	32.7			0.060	0.062		
33	32.5			0.061	0.069		
34	20.7						2000°F Char
35	20.1						800°F Char
36	19.2						850°F Char
37	20.1						800°F Char
38	21.3						1200°F Char
39	21.2						1200°F Char
40	22.2			0.098		0.112	1500°F Char
41	22.0			0.096		0.118	1500°F Char
42	21.6			0.081		0.101	1500°F Char
43	21.6			0.057	0.060	0.053	1200°F Char
44	21.3					0.080	1200°F Char
45	32.1			0.060			
46	32.2			0.062			
47	32.4			0.068			
48	31.9			0.062			
49	32.7	0.010	0.039	0.063	0.068		
50	32.8	0.010	0.043	0.060	0.066		
51	32.5	0.013	0.039	0.059	0.063		
52				0.059			
53				0.055			
54				0.062			
55				0.058			
56				0.058			

TABLE VI

TABULATION OF 5026-39 DATA: SPECIFIC HEAT VALUES AT SELECTED TEMPERATURES

Test No.	Density (lb/ft <sup>3</sup> )	Specific Heat					Remarks
		-250 °F	-100 °F	250 °F	600 °F	700 °F	
1	31.3	0.105	0.180	0.365	0.421	0.260	Virgin
2	31.4	0.107	0.180	0.375	0.400	0.300	Virgin
3	29.6	0.105	0.205	0.365		0.205	Virgin
4	29.1	0.120	0.215	0.350		0.205	Virgin
5	18.7	0.046	0.220	0.256			0.375 1000 °F Char
6	19.7	0.094	0.159	0.223			0.365 1750 °F Char
7	20.8	0.113	0.220	0.264			0.330 1000 °F Char
8	20.8			0.269			0.325 1000 °F Char
9	20.8	0.090	0.160	0.243			0.357 1750 °F Char
10	20.8			0.256			0.365 1750 °F Char
11	30.7			0.340			Virgin
12	30.7			0.336			Virgin

TABLE VII  
 TABULATION OF 5026-39 TEST DATA:  
 THERMAL CONDUCTIVITY AT TEST TEMPERATURES

Test No.	Density (lb/ft <sup>3</sup> )	Test Temp (°F)	Conductivity (K)
3	29.0	-265	0.029
		125	0.040
		124	0.040
		150	0.053
		210	0.054
		292	0.053
		462	0.056
		527	0.063
5	30.9	169	0.047
		233	0.046
		307	0.046
		381	0.045
		415	0.045
		458	0.058
		552	0.064
6	29.5	170	0.046
		237	0.045
		307	0.043
		383	0.042
		418	0.043
7	30.6	170	0.047
		232	0.046
		303	0.045
		377	0.044
8	31.0	136	0.057
		205	0.058
		284	0.059
		403	0.061
		443	0.064
9	30.5	115	0.047
		193	0.049
		268	0.049
		368	0.047
		400	0.048

TABLE VII (Cont'd)

Test No.	Density (lb/ft <sup>3</sup> )	Test Temp (°F)	Conductivity (K)
10	29.8	113	0.051
		185	0.053
		254	0.056
		343	0.057
		397	0.057
11	31.0	134	0.059
		213	0.058
		401	0.062
		440	0.062
12	30.0	120	0.049
		192	0.049
		268	0.047
		366	0.046
		401	0.046
13	29.5	113	0.051
		184	0.054
		253	0.055
		343	0.057
		397	0.058
14	30.3	135	0.054
		204	0.057
		283	0.057
		377	0.060
		429	0.061
15	29.9	114	0.051
		184	0.055
		253	0.057
		342	0.060
		397	0.060
16	29.2	126	0.051
		205	0.055
		262	0.055
		383	0.057
		432	0.058

TABLE VII (Cont'd)

Test No.	Density (lb/ft <sup>3</sup> )	Test Temp (°F)	Conductivity (K)
20	19.9	-267	0.031
		138	0.051
		115	0.088
		184	0.093
		272	0.101
		358	0.107
		453	0.112
		532	0.109
		596	0.110
		691	0.112
		786	0.117
		911	0.121
21	19.7	966	0.121
		-263	0.027
		133	0.050
		125	0.090
		199	0.095
		284	0.102
		373	0.109
		461	0.112
		588	0.102
		660	0.094
		754	0.093
		877	0.091
22	33.8	227	0.058
		317	0.056
		396	0.057
		579	0.060
23	30.3	144	0.056
		223	0.059
		308	0.059
		397	0.060
		487	0.063
		566	0.063

TABLE VII (Cont'd)

Test No.	Density (lb/ft <sup>3</sup> )	Test Temp (°F)	Conductivity (K)
24	32.0	134	0.055
		213	0.057
		308	0.056
		387	0.058
		474	0.061
		562	0.059
25	29.7	-263	0.027
		123	0.039
		137	0.055
		231	0.055
		316	0.054
		405	0.054
		500	0.057
26	31.0	-265	0.032
		127	0.042
		124	0.052
		208	0.053
		297	0.053
		376	0.056
		465	0.058
		514	0.058
27	28.0	-265	0.018
		124	0.039
		129	0.050
		213	0.052
		297	0.052
		381	0.053
		470	0.056
		514	0.058
28	30.9	-259	0.027
		118	0.040
		134	0.054
		218	0.056
		297	0.055
		391	0.057
		475	0.059
		519	0.060

TABLE VII (Cont'd)

Test No.	Density (lb/ft <sup>3</sup> )	Test Temp (°F)	Conductivity (K)
29	28.8	-272 133 139 222 312 475 520	0.028 0.039 0.051 0.053 0.054 0.056 0.059
30	17.6	-246 129 174 268 362 486 556 630 675 774 868 992	0.017 0.026 0.038 0.039 0.042 0.043 0.042 0.042 0.038 0.038 0.036 0.036
32	32.7	137 231 316 405 500	0.057 0.060 0.060 0.061 0.062
33	32.5	138 226 316 410 500	0.059 0.061 0.061 0.065 0.066
34	20.7	667 898 1120 1230 1449 1552 1647	0.176 0.221 0.218 0.238 0.231 0.268 0.257

TABLE VII (Cont'd)

Test No.	Density (lb/ft <sup>3</sup> )	Test Temp (°F)	Conductivity (K)
35	20.1	164 254 343 461 522 602 662 712 800	0.035 0.034 0.035 0.036 0.035 0.035 0.032 0.031 0.030
36	19.3	531 422 611 660 720 770 800	0.038 0.038 0.037 0.037 0.035 0.034 0.034
37	20.1	164 462 531 610 665 720 770 800	0.035 0.038 0.040 0.035 0.035 0.033 0.032 0.032
38	21.3	159 525 471 610 675 775 870 955	0.065 0.077 0.076 0.078 0.078 0.078 0.077 0.080
39	21.2	207 335 428 546 571	0.062 0.069 0.092 0.074 0.070

TABLE VII (Cont'd)

Test No.	Density (lb/ft <sup>3</sup> )	Test Temp (°F)	Conductivity (K)
39 (Cont'd)	21.2	574 667 669 755 755 850 850 941 944	0.074 0.071 0.074 0.074 0.070 0.072 0.069 0.068 0.067
40	22.2	206 333 424 542 571 669 762 853 949	0.098 0.102 0.105 0.111 0.111 0.111 0.115 0.113 0.111
41	22.0	209 333 423 537 565 661 761 850 940	0.094 0.101 0.107 0.110 0.113 0.115 0.116 0.118 0.118
42	21.7	209 333 428 542 571 666 761 855 949	0.079 0.087 0.092 0.097 0.098 0.099 0.101 0.101 0.101

TABLE VII (Cont'd)

Test No.	Density (lb/ft <sup>3</sup> )	Test Temp (°F)	Conductivity (K)
43	21.7	222 342 432 551 581 679 770 864 959	0.057 0.058 0.059 0.060 0.060 0.060 0.059 0.058 0.053
44	21.3	159 471 525 610 675 775 870 955	0.065 0.076 0.070 0.078 0.078 0.078 0.077 0.080
45	32.1	148 217 293 359	0.057 0.058 0.061 0.064
46	32.2	147 226 295 369	0.061 0.061 0.062 0.064
47	32.4	153 222 294 360	0.067 0.067 0.068 0.068
48	31.9	147 216 293 354	0.058 0.061 0.064 0.066
49	32.7	-250 - 83 33	0.010 0.042 0.048

TABLE VII (Concl'd)

Test No.	Density (lb/ft <sup>3</sup> )	Test Temp (°F)	Conductivity (K)
49 (Cont'd)		180	0.063
		269	0.064
		378	0.065
		462	0.068
50	32.8	-249	0.010
		- 97	0.043
		25	0.053
		170	0.058
		255	0.060
		369	0.062
		458	0.063
51	32.5	-261	0.011
		- 87	0.042
		8	0.050
		175	0.058
		279	0.059
		369	0.059
		463	0.063
52		140	0.056
		210	0.060
		287	0.058
		356	0.063
53	30.4	134	0.053
		211	0.055
		280	0.054
		350	0.056
		250	0.060
		125	0.055
		203	0.059
		274	0.060
		350	0.060
54	32.4	135	0.060
		203	0.060
		275	0.063
		347	0.065
55	335	164	0.056
		244	0.058
		280	0.060
		401	0.063
56	33.0	169	0.057
		248	0.058
		286	0.057
		412	0.058

TABLE VIII  
 TABULATION OF 5026-39 TEST DATA:  
 ENTHALPY AT TEST TEMPERATURES

Test No.	Density (lb/ft <sup>3</sup> )	Test Temp (°F)	Enthalpy (Btu/lbm)
1	31.3	-299 -142 -142 213 213 297 271 275 402 402 333 333 406 407 503 505 586 590 706 708	-83.2 -25.7 -27.2 50.4 48.8 83.6 74.6 74.5 122.1 123.6 102.5 102.8 122.2 124.1 167.0 165.2 204.4 204.0 236.9 247.0
2	31.4	-136 206 208 274 274 329 330 405 410 510 513 608 610 704 706 -320 -109 -109 32 32	-24.2 50.4 48.6 74.2 74.3 101.8 103.7 124.1 124.2 167.4 170.0 204.7 206.6 241.4 231.7 -71.8 -45.6 -44.5 -13.6 -12.0

TABLE VIII (Cont'd)

Test No.	Density (lb/ft <sup>3</sup> )	Test Temp (°F)	Enthalpy (Btu/lbm)
3	29.6	-320 -320 -109 -109 32 32 153 208 208 279 281 338 340 407 508 510 604 607 714 725	-75.5 -72.1 -48.4 -45.0 -10.8 -10.3 28.6 49.4 49.0 75.4 75.3 103.1 102.2 122.4 167.4 166.8 200.3 207.6 230.4 234.9
4	29.1	-149 206 208 279 282 339 341 406 510 512 608 611 716 718	-28.6 49.4 49.4 74.2 76.1 101.6 101.4 120.1 166.3 167.1 204.4 204.4 226.3 231.6
5	18.7 (1000°F char)	-320 -320 -109 -109 32 32 140	-60.4 -56.4 -41.4 -40.4 -6.0 -7.1 17.8

TABLE VIII (Cont'd)

Test No.	Density (lb/ft <sup>3</sup> )	Test Temp (° F)	Enthalpy (Btu/lbm)
5 (Cont'd)		205 206 272 272 330 330 398 401 580 579 646 652 764 773 842 844 1006 1010	33.8 33.2 49.5 52.2 71.0 71.4 84.2 89.9 144.1 141.2 165.7 165.3 195.7 201.9 236.8 231.7 283.7 293.9
6	19.7 (1750° F Char)	-320 -320 -109 -109 32 32 140 208 209 276 278 331 333 401 405 578 644 653 771 774 849 849 1001	-56.5 -55.7 -37.3 -31.1 -7.0 -6.5 16.0 32.0 30.4 45.7 45.9 65.6 61.2 77.1 79.9 121.9 152.7 126.2 186.1 182.8 211.0 208.0 260.7

TABLE VIII (Cont'd)

Test No.	Density (lb/ft <sup>3</sup> )	Test Temp (°F)	Enthalpy (Btu/lbm)
7	20.8 (1000°F Char)	-320	-74.72
		-109	-44.29
		-109	-45.56
		32	-9.42
		32	-8.99
		-250	0.113
		-100	0.220
		250	0.264
		1000	0.330
		-320	-73.96
		-109	-64.37
		-109	-61.84
		32	-6.52
		32	-7.66
		139	26.1
		199	45.0
		204	32.9
		245	48.8
		247	51.7
		320	65.2
		322	72.7
		377	86.5
		515	127.8
		617	128.5
		709	181.2
		715	161.9
		842	237.0
		991	274.2
8	20.8 (1000°F Char)	136	10.0
		197	27.4
		197	29.2
		244	41.5
		245	40.8
		320	61.6
		320	59.5
		377	83.4
		380	79.3
		516	124.5
		615	141.1
		704	174.7
		719	171.4
		844	237.0
		996	248.5

TABLE VIII (Cont'd)

Test No.	Density (lb/ft <sup>3</sup> )	Test Temp (°F)	Enthalpy (Btu/lbm)
9	20.8 (1750°F Char)	-320	-57.5
		-320	-48.4
		-109	-59.1
		-109	-54.3
		32	-6.7
		32	-7.8
		133	23.0
		184	32.3
		184	30.5
		248	49.9
		251	41.7
		306	53.6
		306	54.4
		376	69.1
		377	67.9
		524	117.6
		718	156.3
		729	175.3
		836	207.4
		984	266.3
10	20.8 (1000°F Char)	130	18.8
		181	26.1
		182	24.5
		248	41.6
		249	39.7
		308	50.2
		308	47.8
		379	76.6
		523	117.8
		606	138.5
		722	172.9
		724	172.9
		840	198.1
		984	237.3

TABLE VIII (Concl'd)

Test No.	Density (lb/ft <sup>3</sup> )	Test Temp (°F)	Enthalpy (Btu/lbm)
11	30.7	117	15.3
		183	35.3
		186	33.0
		252	60.2
		255	53.1
		261	61.4
		262	65.6
		414	114.6
		415	116.4
12	30.7	188	34.4
		194	32.5
		197	34.1
		197	36.6
		257	57.4
		258	55.1
		407	121.0
		421	114.0
		462	145.6
		466	142.9

TABLE IX  
HEAT OF DECOMPOSITION OF AVCOAT 5026-39

Char Temp (°F)	State	Initial Samp Mass (gms)	Residue gms	percent	Heat of Decomp cal/gms	Oxygen Press (atms)	Remarks
K5-13000-4	Powder	1.000	0.0150	1.5	4464	30	Rerun
	Powder	1.000	0.0377	3.8	4972	30	
	Powder	1.0077	0.5734	56	3678	30	
	Powder	0.9014	0.7442	82	1303	30	
	Powder	0.9375	0.5359	57	3410	30	
	Powder	0.7058	0.4671	66	3576	30	
	Powder	1.000	0.3885	38	6064	30	
	Powder	1.0150	0.6380	62	3401	30	
	Pellet	0.9169	0.6275	68	5263	30	
	Powder	0.7370	0.0065	0.8	7884	30	
		0.4347	0	0	7957	30	
	Powder	0.6563	0.4383	66	2484	30	
	Pellet	0.3814	0.0064	1.6	7654	30	
	Powder	0.5050	0.0078	1.5	7869	30	
M5-13007-2	Powder	1.000	0.0418	4.1	5134	30	Rerun
	Powder	0.9989	0.5698	57	3618	30	
	Powder	0.9650	0.7000	72	2140	30	
	Powder	0.8652	0.4995	58	3357	30	
	Powder	0.9804	0.6404	65	3673	30	
	Powder	0.797	0.7222	90	6134	30	
	Powder	1.000	0.5439	54	5973	30	
	Powder	0.9679	0.6590	68	2633	30	
	Pellet	0.8498	0.5448	64	6381	30	
	Powder	0.8038	0.0059	0.7	7795	30	
		1.0554	0	0	7854	30	
	Pellet	0.4151	0.0037	0.9	7810	30	
	Powder	0.7172	0.4711	65	3413	30	
	Powder	0.9821	0.5040	51	2114	30	
K5-13000-22	Powder	1.000	0.0266	2.6	5191	30	Rerun
	Powder	0.9502	0.5143	54.0	3647	30	
	Powder	0.8510	0.5580	65	2753	30	
	Powder	1.000	0.3925	39	3127	30	
	Powder	1.000	0.3205	32	2894	30	
	Powder	1.000	0.9622	96	5301	30	
	Powder	0.9603	0.6161	64	3298	30	
	Pellet	0.9296	0.6575	71	3799	30	
	Powder	0.7405	0.0096	1	7740	30	
		0.9825	0.0238	2.4	8075	30	
	Powder	0.7672	0.5089	66	2669	30	
	Powder	0.5238	0.0090	1.8	9256	30	

TABLE X  
CHARACTERISTICS OF TFE-FLUOROCARBON-RESIN TEFLON

<u>Melting Point</u>	
Crystalline (up to 80%) below 620°F (no readily evident liquid phase)	
<u>Heat of Fusion</u>	
14 cal/gm (25.2 Btu/lb) at 620°F	
<u>Vapor Pressure</u>	
<u>T°F</u>	<u>mm</u>
615	0.01
752	0.5
932	28
1125	760
<u>Boiling Point</u>	
None: Sublimes	

$$C_p = 0.2234a \times 10^{-t} T,$$

where  $T = ^\circ C$

$a = 2.50$  for powdered

$a = 2.39$  for crystalline (drawn Teflon).

**TABLE XI**  
**ARITHMETIC MEAN AND STANDARD DEVIATION OF OTHER ABLATOR DATA:**  
**APPARENT THERMAL CONDUCTIVITY**

Material	Conductivity						Standard Deviation
	-250 °F	-100 °F	0 °F	100 °F	200 °F	300 °F	
Boost Protective Cover	0.072.	0.063	0.058	0.052	0.046	0.041	0.035
Teflon	0.119	0.124	0.127	0.130	0.133	0.136	0.139
Polyethylene	0.290	0.262	0.243	0.225	0.206	0.187	0.167
Purple Blend	0.152	0.174	0.189	0.204	0.218	0.233	0.248
Epoxy/Fiberglass Laminates	0.136	0.182	0.203	0.218	0.230	0.239	0.248
Phenolic/Fiberglass Laminates	0.200	0.215	0.226	0.236	0.246	0.256	0.266

TABLE XII  
 FIRST-ORDER EQUATIONS OF OTHER ABLATOR DATA: APPARENT THERMAL CONDUCTIVITY

Material	Conductivity	Standard Deviation
Boost Protective Cover	$0.058 - 5.56 \times 10^{-5}T$	$\pm 0.002$
Teflon	$0.127 + 3.10 \times 10^{-5}T$	$\pm 0.005$
Polyethylene	$0.243 - 1.86 \times 10^{-4}T$	$\pm 0.001$
Purple Blend	$0.189 + 1.5 \times 10^{-4}T$	
Epoxy-Fiberglass Laminates	$0.203 + 1.78 \times 10^{-4}T - 2.88 \times 10^{-7}T^2 + 3.04 \times 10^{-10}T^3$	$\pm 0.016$
Phenolic-Fiberglass Laminates	$0.225 + 1.01 \times 10^{-4}T$	$\pm 0.009$

TABLE XIII  
TABULATION OF THERMAL MEASUREMENTS OF ADHESIVES AND SEALS

Material	Property Versus Temperature	Temperature Range (°F)	Figure No.
<u>Adhesives</u>			
HT 424	Apparent Thermal Conductivity	-230 to 570	91
HT 424	Apparent Thermal Conductivity	-195 to 565	92
HT 424	Apparent Thermal Conductivity	150 to 560	93
HT 424	Apparent Thermal Conductivity	160 to 570	94
HT 424	Specific Heat	-360 to 710	95
HT 424	Specific Heat	100 to 700	96
Sylgard 182-2	Apparent Thermal Conductivity	-265 to 395	97
Sylgard 182-2	Apparent Thermal Conductivity	-270 to 530	98
Sylgard 182-2	Apparent Thermal Conductivity	-250 to 550	99
Sylgard 182-2	Apparent Thermal Conductivity	135 to 535	100
Sylgard 182-2	Apparent Thermal Conductivity	135 to 542	101
Sylgard 182-2	Specific Heat	-300 to 750	102
Sylgard 182-2	Specific Heat	100 to 735	103
Sylgard 182-2	Enthalpy and Specific Heat	135 to 450	104
Sylgard 182-2	Enthalpy and Specific Heat	132 to 450	105
Epon 931	Apparent Thermal Conductivity	95 to 430	106
Epon 931	Enthalpy and Specific Heat	155 to 455	107
<u>Seals</u>			
RTV 560	Apparent Thermal Conductivity	-80 to 305	108
RTV 560	Apparent Thermal Conductivity	-95 to 395	109
RTV 560	Apparent Thermal Conductivity	-85 to 410	110
RTV 560	Apparent Thermal Conductivity	-90 to 400	111

TABLE XIV  
ARITHMETIC MEAN AND STANDARD DEVIATION OF VARIOUS SEAL AND ADHESIVE DATA:  
APPARENT THERMAL CONDUCTIVITY

Material	Conductivity						Standard Deviation
	-250 °F	-100 °F	0 °F	100 °F	200 °F	300 °F	
HT 424	0.226	0.312	0.363	0.409	0.446	0.474	0.497 0.489 ± 0.018
Sylgard	0.086	0.090	0.092	0.093	0.092	0.089	0.086 0.081 ± 0.006
Epon 931	0.152	0.174	0.189	0.204	0.218	0.233	0.248 0.263 0.278 ± 0.009
RTV 560	0.152	0.174	0.189	0.204	0.218	0.233	0.248 0.263 0.278 ±

TABLE XV

FIRST-ORDER EQUATIONS OF VARIOUS SEAL AND ADHESIVE DATA: APPARENT THERMAL CONDUCTIVITY

Material	Conductivity	Standard Deviation
HT 424	$0.363 \times 10^{-4} T - 3.14 \times 10^{-7} T^2 - 2.47 \times 10^{-10} T^3$	$\pm 0.018$
Sylgard 182	$0.093 \times 10^{-5} T - 6.62 \times 10^{-8} T^2$	$\pm 0.006$
Epon 931	$0.189 \times 10^{-4} T$	$\pm 0.009$
RTV 560	$0.189 \times 10^{-4} T$	$\pm$

TABLE XVI  
 ARITHMETIC MEAN AND STANDARD DEVIATION OF VARIOUS INSULATION DATA:  
 APPARENT THERMAL CONDUCTIVITY

Material	Conductivity										Standard Deviation	
	-250	-100	0	100	200	300	400	500	600	700	800	
TG 15000 TG 15000, Vacuum	0.0068	0.0122	0.0152	0.0177	0.0198	0.0215	0.0230	0.0243	0.0255	0.0266	0.0277	0.0289
NRC-2 500 Layers/ inch	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
NRC-2 1000 Layers/ inch	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026
NRC-2 2000 Layers/ inch	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036
SI 62	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021
SI 62, Vacuum ( $\times 10^{-4}$ )	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3

TABLE XVII

## FIRST-ORDER EQUATIONS OF VARIOUS INSULATION DATA: APPARENT THERMAL CONDUCTIVITY

Material	Conductivity	Standard Deviation
TG 15000 TG 15000 Vacuum $200 \leq T \leq 800^{\circ}\text{F}$	$0.015 + 2.70 \times 10^{-5}T - 2.33 \times 10^{-8}T^2 + 1.14 \times 10^{-11}T^3$ $-3.25 \times 10^{-3} + 2.82 \times 10^{-5}T - 6.11 \times 10^{-8}T^2 \times 4.54 \times 10^{-11}T^3$	$\pm 0.002$ $\pm 6.5 \times 10^{-4}$
NRC-2, 500 Layers per inch	$0.017 + 3.32 \times 10^{-9}T$	$\pm 0.008$
NRC-2, 1000 Layers per inch (includes 50 Layers/0.050 inch)	$0.026 + 3.11 \times 10^{-9}T$	$\pm 0.010$
NRC-2, 2000 Layers per inch	$0.036 + 7.09 \times 10^{-9}T$	$\pm 0.003$
SI 62	$0.021 + 5.42 \times 10^{-9}T$	$\pm 0.007$
SI 62, Vacuum	$4.32 \times 10^{-4} + 3.72 \times 10^{-11}T$	$\pm 1.8 \times 10^{-4}$

TABLE XVIII  
APPARENT THERMAL CONDUCTIVITY TEST RESULTS: RAW DATA TABULATION

Hot Face (° F)	Avg Temp (° F)	ΔT (° F)	Thickness (in.)	Gradient (° F/ft)	Heat Flux (Btu/hr-ft <sup>2</sup> )	Conductivity (K) (Btu/hr-ft-°F)	Conductance (C) (Btu/hr-ft <sup>2</sup> -°F)
<u>TG15000 0002N</u>							
111	-202	182	0.500	4368.0	38.4	0.0088	
157	-49	412		9888.0	148.3	0.015	
158	137	42		1008.0	17.1	0.017	
240	218	44		1056.0	20.1	0.019	
337	315	44		1056.0	32.2	0.022	
418	395	46		1104.0	25.4	0.023	
518	495	46		1104.0	25.4	0.023	
160	139	42		1008.0	17.1	0.017	
240	219	42		1008.0	19.2	0.019	
460	438	44		1056.0	29.6	0.028	
650	628	44		1056.0	34.8	0.033	
480	451	58	0.495	1406.0	25.3	0.018	
662	632	60		1454.6	32.0	0.022	
820	789	62		1503.0	39.1	0.026	
965	933	64		1551.5	43.4	0.028	
<u>TG15000 0003N</u>							
215	-30	490	0.500	11760.0	172.9	0.0147	
100	-206	214		5136.0	37.5	0.0073	
71	-190	235		5640.0	60.3	0.0107	
68	-188	240		5760.0	42.6	0.0074	
160	139	42		1008.0	18.1	0.018	
240	218	44		1056.0	21.1	0.020	
460	437	46		1104.0	27.6	0.025	
650	627	46		1104.0	27.6	0.025	
480	451	58	0.496	1406.0	29.5	0.021	
662	632	60		1454.5	33.3	0.023	
835	804	62		1503.0	39.0	0.026	
962	929	66		1599.9	44.2	0.028	
160	139	42	0.500	1008.0	20.2	0.020	
330	308	44		1056.0	23.2	0.022	
420	397	46		1104.0	25.4	0.023	
500	477	46		1104.0	26.5	0.024	
<u>TG15000 0004N</u>							
-45	-170	249	0.500	5976.0	65.1	0.0109	
84	-102	372		5928.0	116.1	0.013	
237	-20	515		12360.0	173.0	0.014	
150	130	40		960.0	18.2	0.019	
320	298	44		1056.0	23.2	0.022	
415	393	44		1056.0	25.3	0.024	
500	478	44		1056.0	26.4	0.025	
160	139	42		1008.0	18.1	0.018	
240	218	44		1056.0	21.1	0.020	
360	338	44		1056.0	25.3	0.024	
560	537	46		1104.0	28.7	0.026	
480	452	56	0.495	1357.6	32.6	0.024	
662	633	58		1406.0	38.0	0.027	
825	795	60		1454.5	42.2	0.029	
960	929	62		1503.0	49.6	0.033	
<u>SST H/C 0.008 FP T0005N</u>							
140	117	46	0.514	1073.9	112.1	0.209	5.04
215	187	56		1307.4	152.8	0.234	5.64
290	261	58		1354.1	170.4	0.252	6.07
350	318	64		1494.1	188.1	0.252	6.07
<u>SST H/C 0.008 FP T0007N</u>							
170	150	40	0.513	936	105.2	0.225	5.26
250	230	40		936	112.6	0.241	5.63
340	318	44		1029	133.7	0.260	6.08
403	381	44		1029	144.5	0.287	6.71
170	150	40		936	104.2	0.223	5.21
255	234	42		982	119.5	0.244	5.70
320	300	40		936	124.4	0.266	6.22
435	413	44		1029	152.7	0.297	6.94
170	150	40		936	104.7	0.224	5.24
250	230	40		936	114.5	0.245	5.73
310	309	42		982	131.6	0.268	6.27
460	438	44		1029	155.8	0.303	7.08

**TABLE XVIII (Cont'd)**

Hot Face (°F)	Avg Temp (°F)	ΔT (°F)	Thickness (in.)	Gradient (°F/ft)	VAC (u)	Heat Flux (Btu/hr-ft <sup>2</sup> )	Conductivity (K) (Btu/hr-ft <sup>-2</sup> -°F)	Conductance (C) (Btu/hr-ft <sup>2</sup> -°F)
<b>AL H/C NAA 0.96 T0008N</b>								
140	129	22	1.0015	263.6		336.9	1.28	15.3
185	167	36		431.4		589.3	1.37	16.4
235	213	44		527.2		766.5	1.45	17.4
290	267	46		551.2		848.8	1.54	18.4
<b>SST H/C 0.008 FP T0009</b>								
170	150	40	0.514	933.8		103.8	0.222	5.19
250	229	42		980.5		117.3	0.239	5.58
330	308	44		1027.2		133.2	0.259	6.05
460	438	44		1027.2		150.1	0.292	6.82
250	229	42		980.5		114.4	0.233	5.44
320	299	42		980.5		128.1	0.261	6.10
400	378	44		1027.2		145.5	0.283	6.61
170	150	40		933.8		103.8	0.222	5.19
255	234	42		980.5		109.9	0.244	5.70
330	308	44		1027.2		134.7	0.262	6.12
430	408	44		1027.2		147.0	0.286	6.68
<b>SST H/C 0.008 FP T0010N</b>								
170	150	40	0.514	934		105.0	0.225	5.42
255	233	44		1027		127.3	0.248	5.98
330	309	42		934		134.2	0.274	6.60
460	438	44		1027		160.7	0.313	7.54
<b>SST H/C 0.008 FP T0011N</b>								
-281	-296	30	0.514	712.6		76.6	0.109	2.54
32	-12	40		2030.2		302.5	0.149	3.48
170	150	40		934		204.5	0.219	5.11
260	238	44		1027		242.4	0.236	5.51
330	308	44		1027		270.1	0.263	6.14
458	436	44		1027		303.1	0.295	6.89
<b>SST H/C 0.008 FP T0012N</b>								
-244	-270	52	0.514	1190.3		116.6	0.098	2.29
-99	-169	140		3255.9		390.7	0.120	2.80
63	9	108		2485.8		390.3	0.157	3.66
170	150	40		934		207.0	0.222	5.18
255	234	42		980		238.1	0.243	5.67
330	308	44		1027		270.1	0.263	6.14
460	437	46		1074		321.1	0.299	6.98
<b>SST H/C 0.008 FP T0013N</b>								
-185	-228	86	0.514	1984.0		218.2	0.110	2.57
99	34	130		3022.5		477.6	0.158	3.69
170	150	40		934		209.2	0.224	5.23
255	234	42		980		243.0	0.248	5.79
330	307	42		980		272.4	0.278	6.49
460	436	44		1027		321.4	0.313	7.31
<b>AL H/C 1/2-in. T0014N</b>								
-258	-276	36	0.523	826		401.7	0.493	11.8
-30	-51	42		963		684.8	0.697	16.7
74	63	22		505		432.3	0.856	20.5
288	266	44		1009		1190.6	1.18	27.0
400	377	46		1055		1413.7	1.34	30.7
610	586	48		1101		1893.7	1.72	39.5
<b>AL H/C 1/2-in. T0015N</b>								
295	280	30	0.523	1440	45	305.3	0.212	5.09
363	342	42		2016	45	441.5	0.219	5.26
455	438	44		1632	72	429.2	0.263	6.31
510	493	44		1632	43	571.2	0.350	8.40
625	600	50		2400	140	1188	0.495	11.9
368	355	26		596	28	216.3	0.363	8.71
440	424	32		734	30	283.3	0.386	9.26
630	608	44		1009	50	440.9	0.437	10.49

TABLE XVIII (Cont'd)

Hot Face (°F)	Avg Temp (°F)	ΔT (°F)	Thickness (in.)	VAC (u)	Gradient (°F/ft)	Heat Flux (Btu/hr-ft²)	Conductivity (K) (Btu/hr-ft²-°F)	Conductance (C) (Btu/hr-ft²-°F)
<u>AL H/C 1/2-In. T0016N</u>								
-236	-259	46	0.523		1055	529.6	0.502	12.0
-239	-262	46			1055	527.5	0.500	12.0
-78	-85	14			321	234.6	0.731	17.5
-24	-47	46			1055	763.8	0.724	17.4
170	157	26			597.7	593.4	0.993	24.5
300	275	50			1149.4	1264.3	1.10	27.2
410	385	50			1149.4	1459.7	1.27	31.4
580	553	54			1241.4	1663.5	1.34	33.1
<u>AL H/C 1/2-In. T0017N</u>								
-261	-279	36	0.523		826	394.0	0.477	11.4
-39	-58	38			872	576.4	0.661	15.8
96	80	32			734	637.8	0.869	20.8
180	167	26			596.6	609.1	1.02	23.4
320	294	52			1193.1	1361.3	1.14	26.2
440	409	62			1422.6	1782.5	1.25	28.8
603	571	64			1468.4	2079.2	1.42	32.5
<u>AL H/C 3/4-In. T0018N</u>								
-61	-71	20	0.780		301.5	269.5	0.894	13.8
052	-64	24			369.2	340.4	0.922	14.2
-184	-213	58			876.9	638.4	0.729	11.2
176	159	34			523	569	1.09	16.7
268	245	46			708	797	1.13	17.3
411	385	52			800	981	1.23	18.9
512	485	54			831	1096	1.32	20.3
<u>AL H/C 1/2-In. T0019N</u>								
300	288	24	0.524	0.37	1151	288	0.25	5.99
380	365	50		0.38	1439	374	0.26	6.24
448	433	30		0.40	1439	460	0.32	7.67
518	502	32		0.40	1535	583	0.38	9.11
640	623	34		0.046	1631	816	0.50	12.0
<u>AL H/C 1-In. T0020N</u>								
292	276	32	1.028	28	384.0	168.2	0.438	5.26
368	349	38		28	456	215.7	0.473	5.68
440	420	40		28	480	246.7	0.514	6.17
493	470	46		30	552	332.3	0.602	7.22
628	603	50		45	600	456.6	0.761	9.13
630	605	50		0.048	600	435.6	0.726	8.71
<u>AL H/C 1-In. T0021N</u>								
288	265	46	1.028	0.15	531.3	163.6	0.308	3.56
385	363	44		0.11	508.2	166.7	0.328	3.79
460	438	44		0.09	508.2	204.8	0.403	4.65
532	509	46		0.10	531.3	235.9	0.444	5.13
648	623	50		0.06	577.5	356.3	0.617	7.13
<u>AL H/C 3/4-In. T0022N</u>								
-240	-258	36	0.780		563.1	364.9	0.648	9.97
-36	-52	32			501.5	440.8	0.879	13.5
170	152	36			552.1	527.8	0.956	14.7
240	218	44			674.8	695.0	1.03	15.8
458	432	52			797.4	979.2	1.23	18.8
540	513	54			828.1	1006.1	1.22	18.6
<u>AL H/C 3/4-In. T0023N</u>								
-258	-271	26	0.780		421.5	266.0	0.631	9.71
-222	-244	44			661.5	445.2	0.673	10.4
-76	-82	12			206.2	168.7	0.818	12.6
160	143	34			524.4	499.2	0.952	14.7
310	285	50			771.2	767.3	0.995	15.4
430	403	54			832.9	1010.3	1.21	18.7
650	622	56			863.8	1146.3	1.33	20.5

TABLE XVIII (Cont'd)

Hot Face (°F)	Avg Temp (°F)	ΔT (°F)	Thickness (in.)	Gradient (°F/ft)	Heat Flux (Btu/hr-ft <sup>2</sup> )	Conductivity (K) (Btu/hr-ft <sup>-2</sup> -°F)	Conductance (G) (Btu/hr-ft <sup>2</sup> -°F)
<b>AL H/C 1-In. T0024N</b>							
-270	-283	25	1.029	297.2	240.2	0.808	9.42
-243	-260	34		402.1	344.6	0.857	9.98
-60	-127	134		1568.0	1660.5	1.05	12.3
35	121	27		320.5	360.9	1.13	13.1
177	156	42		489.5	559.9	1.14	13.3
310	285	50		582.8	737.2	1.26	14.7
450	422	56		652.7	911.8	1.40	16.3
579	551	56		652.7	1039.1	1.59	18.6
<b>AL H/C 1-In. T0025N</b>							
-240	-258	37	1.023	437.1	373.7	0.855	9.97
-228	-248	41		477.9	428.7	0.897	10.4
-101	-155	104		1217.9	1118.1	0.918	10.7
-8	-30	44		512.8	568.2	1.11	12.9
188	168	40		466.7	494.2	1.06	12.4
323	300	46		536.7	631.7	1.18	13.7
449	423	52		606.7	817.8	1.35	15.7
583	555	56		653.4	978.1	1.50	17.5
<b>AL H/C NAA 0.96-In. T0026N</b>							
-280	-287	15	0.992	182	132.6	0.703	8.50
-177	-207	60		726	580.9	0.790	9.56
-98	-144	93		1125	980.1	0.862	10.4
-14	-36	44		532	513.6	0.958	11.6
180	162	36		435	530.9	1.22	14.7
280	260	40		484	645.5	1.33	16.2
390	369	42		508	745.9	1.47	17.8
500	478	44		532	840.9	1.58	19.1
<b>AL H/C NAA 0.96-In. T0027N</b>							
-256	-270	28	0.992	339	244.5	0.721	8.74
-131	-170	78		944	862.4	0.909	11.0
-94	-143	98		1186	1052.9	0.882	10.7
-4	-28	48		581	584.2	0.992	12.0
180	159	42		508.1	644.3	1.27	15.3
300	280	40		483.9	654.7	1.35	16.4
390	369	42		508.1	762.6	1.50	18.2
460	438	44		528.0	845.3	1.60	19.4
<b>AL H/C NAA 0.96-In. T0028N</b>							
-204	-229	50	0.992	605	474.5	0.773	9.35
-79	-132	106		1282	1176.4	0.910	11.0
0	-24	48		581	583.8	1.00	12.1
49	411	75		908	973.6	1.06	12.8
170	151	38		459.7	538.8	1.17	14.1
305	284	42		508.1	706.8	1.39	16.8
415	394	42		508.1	753.0	1.48	17.9
590	565	50		604.8	936.8	1.54	18.7
<b>AL H/C 1-In. T0029N</b>							
-201	-228	54	1.028	629.4	556.9	0.885	10.3
-199	-227	56		652.7	578.9	0.887	10.3
-20	-42	44		512.8	568.2	1.11	12.9
36	7	59		693.5	797.5	1.15	13.4
185	164	42		490.0	526.8	1.08	12.5
316	292	48		560.0	666.4	1.19	13.9
451	429	44		513.4	658.6	1.28	15.0
585	556	58		676.7	966.3	1.43	16.7
<b>SST H/C 0.015 FP T0030N</b>							
44	8	72	0.514	1625.3	268.2	0.165	3.72
-3	-25	44		981.9	164.0	0.167	3.76
14	-13	54		1218.9	204.8	0.168	3.79
170	150	40		934	208.3	0.223	5.21
310	288	44		1027	268.0	0.261	6.10
420	398	44		1027	290.6	0.283	6.61
550	527	46		1074	336.2	0.313	7.31

TABLE XVIII (Cont'd)

Hot Face (°F)	Avg Temp (°F)	ΔT (°F)	Thickness (in.)	Gradient (°F/ft)	Heat Flux (Btu/hr-ft <sup>2</sup> )	Conductivity (K) (Btu/hr-ft <sup>-2</sup> °F)	Conductance (G) (Btu/hr-ft <sup>2</sup> °F)
<u>SST H/C 0.015 FP T0031N</u>							
-206	-224	36	0.514	790.0	136.7	0.173	3.90
36	2	68		1523.7	263.6	0.173	3.90
170	150	40		934	207.3	0.222	5.19
310	288	44		1027	259.8	0.253	5.92
380	358	44		1027	287.6	0.280	6.55
630	608	44		1027	363.6	0.354	8.28
<u>SST H/C 0.015 FP T0032N</u>							
-175	-196	42	0.514	948.1	165.9	0.175	3.95
68	24	48		1975.1	331.8	0.168	3.79
23	-8	62		1388.2	237.4	0.171	3.86
170	150	40		934	208.3	0.223	5.21
310	289	42		980	253.8	0.259	6.06
470	448	44		1027	314.3	0.306	7.15
635	613	44		1027	359.4	0.350	8.18
<u>AL H/C 1/8-001-2 0056N</u>							
-16.45	-43.43	53.96	1.984	329.17	587.24	1.784	10.89
-113.25	-175.70	124.9		761.22	1130.41	1.485	9.07
-231.90	-260.88	57.96		353.70	462.20	1.205	7.357
140	119.8	41.4		250.40	517.82	2.068	12.50
340	317.6	44.8		270.96	662.49	2.445	14.78
472	447.5	49		296.37	760.18	2.565	15.51
618	592.5	51		308.46	898.23	2.912	17.61
<u>AL H/C 1/8-003-3/8 T0075N</u>							
-90.70	-94.23	7.06	0.359	249.12	484.54	1.945	68.73
-266.65	-280.63	27.96		987.63	1375.77	1.393	49.22
140	137.5	5		167.13	535.98	3.207	107.22
330	324.41	11.18		373.70	859.51	2.300	76.89
470	463.02	13.96		466.63	1105.91	2.37	79.24
605	596.87	16.26		543.50	1342.45	2.47	82.58
<u>AL H/C 1/8-003-3/8 T0076N</u>							
-101.05	-102.28	2.46	0.359	86.58	163.20	1.885	66.61
-284.00	-293.95	19.9		703.18	895.15	1.273	44.98
138	135.24	5.52		184.51	451.31	2.446	81.78
	325.12	9.76		326.24	790.15	2.422	80.98
470	463.6	12.80		427.86	1010.18	2.361	78.94
608	600.54	14.92		498.72	1226.85	2.460	82.25
<u>AL H/C 3/16-003-2 T0068N</u>							
-29.6	-53.43	47.7	1.9785	290.90	735.10	2.527	15.43
-77.30	-86.98	19.4		118.13	286.35	2.424	14.80
-149.85	-213.63	127.6		779.69	1538.33	1.973	12.05
-227.7	-261.83	68.3		416.67	745.84	1.790	10.93
142	131.2	121.6		131.00	352.78	2.693	16.33
348	333.2	29.6		179.52	660.99	3.682	22.33
485	468.2	33.6		203.79	821.07	4.029	24.44
622	603.8	36.4		220.77	977.57	4.428	26.86
<u>AL H/C 3/16-003-2 T0069N</u>							
-36.25	-60.50	48.4	1.9785	296.09	737.26	2.490	15.20
-84.45	-92.00	15.0		92.19	205.95	2.234	13.64
-158.55	-219.03	120.9		738.39	1441.33	1.952	11.92
240.00	269.90	59.8		366.08	638.44	1.744	10.65
148	136.4	23.4		141.675	857.842	3.202	19.39
338	321.5	33.2		201.009	710.16	3.533	21.4
480	461.7	36.3		221.594	859.785	3.88	23.49
618	598.7	38.6		233.703	985.526	4.217	25.53
<u>AL H/C 1/8-003-1 T0077N</u>							
-86.75	-92.30	11	0.9825	138.23	478.12	3.524	43.89
-256.00	-254.35	3		581.57	1470.21	2.528	31.48
138	132.2	11.6		141.679	590.376	4.167	50.897
320	310.3	19.4		236.946	1051.566	4.438	54.208
462	450.2	23.6		288.244	1317.852	4.572	55.844
595	582.1	25.8		315.114	1556.348	4.939	60.327

**TABLE XVIII (Cont'd)**

Hot Face (°F)	Avg Temp (°F)	ΔT (°F)	Thickness (in.)	Gradient (°F/ft)	Heat Flux (Btu/hr-ft <sup>2</sup> )	Conductivity (K) (Btu/hr-ft <sup>-2</sup> °F)	Conductance (C) (Btu/hr-ft <sup>2</sup> °F)
<b>AL H/C 1/8-003-1 T0078N</b>							
-98.70	-100.63	3.9	0.9825	47.95	162.50	3.389	42.40
-270.95	-289.50	37.0	0.9825	462.02	1115.32	2.414	30.06
132	129.8	10.48	0.98025	128.293	553.840	4.317	52.853
318	307.6	20.8		254.628	1167.978	4.587	56.158
458	445.4	25.2		308.492	1447.136	4.691	57.431
590	577.3	25.4		310.941	1642.701	5.283	64.679
<b>AL H/C 1/8-003-3/8 T0076</b>							
-101.05	-102.28	2.46	0.359	86.58	163.20	1.885	66.61
-284.00	-293.95	19.9		703.18	895.15	1.273	44.98
138	135.24	5.52		184.51	451.31	2.446	81.78
330	325.12	9.76		326.24	790.15	2.422	80.98
470	463.6	12.80		427.86	1010.18	2.361	78.94
608	600.54	14.92		498.72	1226.85	2.460	82.25
<b>AL H/C 1/8-003-2 T0073N</b>							
145	137.4	15.2	1.9821	92.02	443.90	4.824	29.20
345	333.98	22.04		133.43	696.10	5.217	31.58
486	473.3	25.4		153.77	870.18	5.659	34.26
628	615.36	25.28		153.05	987.17	6.450	39.05
<b>AL H/C 1/8-003-2 T0074N</b>							
158	150.5	14.8	1.98375	89.53	419.	4.68	28.30
345	335.1	19.8		119.77	614.42	5.13	31.02
488	476.8	22.4		135.50	747.96	5.52	33.39
628	616.4	23.2		140.34	812.57	5.79	35.02
<b>AL H/C 1/8-001-3/4 T0083N</b>							
150	144.7	10.6	0.733	173.53	208.7	1.779	29.12
348	338.3	19.4		317.59	563.	1.773	29.03
483	471.5	23.0		376.53	697.33	1.852	30.32
610	596.1	27.8		455.11	878.36	1.930	31.59
<b>AL H/C 1/8-001-3/4 0092N</b>							
140	134	12.0	0.733	196.45	348.50	1.774	29.0
330	317	26.0		425.65	775.10	1.821	29.8
470	454	32.0		523.87	1014.74	1.937	31.7
590	570	40.0		654.84	1361.41	2.079	34.0
<b>AL H/C 3/16-001-3/4 T0087N</b>							
148	139.6	16.8	0.7310	275.79	347.49	1.260	20.68
338	323.4	29.2		479.34	675.87	1.410	23.15
480	463.5	33.0		541.72	838.58	1.548	25.42
<b>AL H/C 3/16-001-3/4 T0086N</b>							
150	142.7	14.6	0.7335	238.85	289.49	1.212	19.82
338	321.5	33.0		539.88	728.84	1.350	22.08
470	450.03	39.8		651.12	962.36	1.478	24.18
608	586.5	43.0		703.48	1138.93	1.619	26.49
<b>AL H/C 3/16-001-2 0043N</b>							
-80.80	-91.55	21.5	1.983	131.42	162.04	1.233	7.54
-75.25	-185.33	220.16		1345.66	1480.23	1.100	6.72
-106.25	-203.63	194.76		1190.41	1260.64	1.059	6.47
-164.35	-233.65	138.6		847.19	840.41	0.992	6.06
170	150	40	1.9839	241.95	391.47	1.618	9.787
368	344	48		290.34	551.93	1.901	11.498
500	474	52		314.54	667.45	2.122	12.835
640	613	54		326.63	784.89	2.403	14.535
<b>AL H/C 3/16-001-2 0047N</b>							
360	333.5	53	1.9843	320.532	596.510	1.861	11.254
500	471	58		350.770	726.444	2.071	12.524
640	613.5	53		320.532	759.660	2.370	14.333

**TABLE XVIII (Cont'd)**

Hot Face (°F)	Avg Temp (°F)	AT (°F)	Thickness (in.)	Gradient (°F/ft)	Heat Flux (Btu/hr-ft <sup>2</sup> )	Conductivity (K) (Btu/hr-ft <sup>-2</sup> °F)	Conductance (C) (Btu/hr-ft <sup>-2</sup> °F)
<b><u>AL H/C 3/16-0015-1 T0106N</u></b>							
142	135	14	0.979	171.60	291.03	1.696	20.78
330	319	22		269.66	518.82	1.924	23.58
480	467	26		318.69	667.33	2.094	25.66
608	594	28		343.20	741.31	2.160	26.47
<b><u>AL H/C 3/16-0015-3/8 T0107N</u></b>							
	135	6	0.358	201.11	275.32	1.369	45.89
315	306	18		603.35	789.78	1.309	43.88
460	450	20		670.39	937.20	1.398	46.86
585	574	22		737.43	1096.56	1.487	49.85
<b><u>AL H/C 3/16-0015-2 T0108N</u></b>							
	128	20	1.975	121.52	236.48	1.946	11.82
333	316	34		206.58	471.62	2.283	13.87
478	458	40		243.04	598.12	2.461	14.95
610	588	44		267.34	674.49	2.523	15.32
<b><u>0109N AL H/C Horiz Core: No Face Plat W/TC, No Groove 3/16-001, Q ⊥ to cells, ⊥ to NB</u></b>							
253	246	14	0.742	227.64	117.68	0.517	8.406
495	485	20		325.20	192.84	0.593	9.642
616	604	24		390.24	238.05	0.610	9.918
<b><u>AL H/C 1/8-001-2 0048N</u></b>							
-30.75	-53.35	.45.2	1.984	275.78	490.89	1.780	10.87
-97.15	-166.85	139.4		850.70	1265.85	1.488	9.08
-220.85	-253.25	64.8		395.51	496.37	1.255	7.660
160	144.2	31.6		191.406	416.69	2.177	13.186
360	338	44.0		266.515	651.895	2.446	14.816
	464	48		290.744	775.704	2.668	16.16
638	612.5	51		308.915	906.974	2.936	17.784
<b><u>AL H/C 3/16-003-1 T0066N</u></b>							
-62.80	-78.25	46.35	0.983	384.33	895.10	2.329	28.97
211.75	-256.28	49.06		610.08	1562.41	2.561	31.85
148.0	140.5	15.0	0.985	182.83	484.13	2.648	32.28
330.0	318.3	23.4		285.22	832.56	2.919	35.58
478.0	464.8	26.4		321.78	1036.13	3.220	39.25
610.0	593.3	29.4		358.35	1247.06	3.480	42.42
<b><u>AL H/C 3/16-003-1 T0067N</u></b>							
-69.20	-81.35	24.30	0.983	302.86	712.33	2.352	29.25
-263.15	-280.20	34.10		424.13	948.35	2.235	27.81
148.0	140.3	15.4		187.94	462.14	2.459	29.99
328.0	315.2	25.6		312.42	849.16	2.718	33.16
472.0	458.3	27.4		334.38	1005.15	3.006	36.67
605.0	590.1	29.8		363.67	1189.67	3.270	39.89
<b><u>AL H/C 1/4-001-3/8 0049N</u></b>							
-59.95	-68.03	16.2	0.359	539.96	381.91	0.7073	23.65
-83.15	-87.20	8.1		270.81	180.95	0.6682	22.34
-184.35	-218.47	68.24		2281.84	1364.54	0.598	19.99
-249.65	-267.50	35.7		1193.57	690.71	0.578	19.34
160	148.6	22.8	0.361	757.89	604.79	0.798	26.53
338	319.0	37.3		1256.50	1143.41	0.910	30.25
480	459.8	40.4		1342.93	1357.7	1.011	33.60
655	634	42.0		1396.12	1537.13	1.101	36.60
<b><u>AL H/C 1/4-001-3/8 T0057N</u></b>							
-70.50	-76.80	12.6	0.359	421.26	306.76	0.7282	24.35
-146.10	-192.05	91.9		3072.55	1840.45	0.599	20.03
-214.25	-242.28	56.1		1867.27	1056.87	0.566	18.92
-302.50	-306.25	7.5		250.75	156.61	0.624	20.88
175	164	22		741.57	619.21	0.835	28.11
330	310.9	28.2		1287.64	1156.30	0.898	30.24
487	466	42.0		1415.73	1387.42	0.980	32.99
658	632.6	44.8		1510.11	1535.78	1.017	34.24

**TABLE XVIII (Cont'd)**

Hot Face ("F")	Avg Temp ("F")	$\Delta T$ ("F")	Thickness (in.)	Gradient ("F/ft)	Heat Flux (Btu/hr-ft <sup>2</sup> )	Conductivity (K) (Btu/hr-ft <sup>-2</sup> -°F)	Conductance (C) (Btu/hr-ft <sup>2</sup> -°F)	VAC
<b>AL H/C 3/16-001-2 0042N</b>								
-26.60	-61.70	70.2	1.983	429.09	541.94	1.263	7.72	
-32.10	-182.30	300.4		1443.87	1549.27	1.073	6.56	
-81.05	-188.38	214.66		1312.04	1415.69	1.079	6.60	
-141.70	-221.40	159.5		974.33	991.87	1.018	6.22	
351	326	50	1.9825	302.65	560.20	1.851	11.204	
493	465	56		338.97	686.4	2.025	12.257	
638	602	56		338.97	793.2	2.340	14.164	
<b>AL H/C (2.039-In. Overall) Instrumented T/C LOC 3/8-In. From Top</b>								
188	163	50	2.039	294.26	373.98	1.2709	7.480	
238	212	52		306.03	408.86	1.336	7.863	
375	349	54		317.80	501.80	1.579	9.294	
476	448	56		329.57	573.78	1.741	10.247	
507	478	58		341.34	599.73	1.757	10.341	
537	509	56		329.57	603.51	1.8312	10.778	
559	530	58		341.34	616.46	1.806	10.629	
584	555	58		341.34	633.18	1.855	10.918	
632	603	58		341.34	640.35	1.876	11.041	
<b>AL H/C 1.745-In. Overall 0036N</b>								
151	130	42	1.7435	3492.72	4187.77	1.199	8.309	
236	211	50		4158.00	5180.87	1.246	8.635	
327	300	54		4490.69	6111.76	1.361	9.432	
439	414	50		4158.00	711.02	1.710	11.850	
<b>AL H/C 1.740-In. Overall Instrumented With 9 Thermocouples</b>								
176	153	46	1.740	319.1	354.2	1.11	7.70	
231	206	50		346.83	392.09	1.1305	7.84	
315	289	88		360.7	476.1	1.32	9.15	
437	409	56		388.44	552.21	1.4216	9.86	
569	541	56		388.44	626.63	1.6132	11.19	
<b>TC 15000 T0033N (VAC)</b>								
270	242	56	0.103		7.0x10 <sup>-4</sup>			15u
336	309	54			3.9x10 <sup>-4</sup>			15u
493	466	54			1.1x10 <sup>-3</sup>			17u
580	550	60			1.4x10 <sup>-3</sup>			40u
<b>TG 1500 T0040 (VAC)</b>								
266	234	64	0.103		7.2x10 <sup>-4</sup>			33u
278	249	58			4.4x10 <sup>-4</sup>			
390	349	82			2.6x10 <sup>-4</sup>			
480	442	76			11.3x10 <sup>-4</sup>			
575	540	70			15.6x10 <sup>-4</sup>			
645	604	82			23.0x10 <sup>-4</sup>			
745	708	74			34.3x10 <sup>-4</sup>			
845	810	70			37.4x10 <sup>-4</sup>			
875	833	84			48.2x10 <sup>-4</sup>			
<b>AL H/C 1/4-003-3/8 0051N</b>								
-73.00	-82.38	18.76	0.3545	672.04	821.23	1.222	43.80	
-94.90	-97.75	5.70		204.30	248.84	1.218	43.66	
-254.65	-275.10	40.9		1465.95	1410.24	0.962	34.48	
-280.35	-293.10	25.5		913.98	818.01	0.895	32.08	
138	133.8	8.4		282.74	486.87	1.722	57.97	
310	298.6	22.6		760.72	1322.13	1.738	58.51	
450	436.3	27.4		922.30	1685.96	1.828	61.54	
588	572.7	30.6		1030.01	2058.98	1.999	67.30	
<b>AL H/C 1/8-001-2 (VAC) 0060N</b>								
300	291	18	1.981	109.0	204.9	1.88	11.39	4u
445	428	34		205.9	444.7	2.16	13.08	10u
488	468	40		242.3	566.98	2.34	14.17	15u
610	587	46		278.6	718.79	2.58	15.63	15u
695	666	58		351.3	966.08	2.75	16.66	25u
<b>AL H/C 3/16-001-2 (VAC) T0063N</b>								
319	310	18	1.9835	108.9	118.70	1.09	6.59	28u
470	456	28		169.4	260.88	1.54	9.32	32u
540	521	38		239.9	439.11	1.91	11.56	15u
618	594	48		290.4	638.88	2.20	13.31	20u
707	675	64		387.2	882.82	2.28	13.79	25u

**TABLE XVIII (Cont'd)**

Hot Face ("F)	Avg Temp ("F)	ΔT ("F)	Thickness (in.)	Gradient ("F/ft)	Heat Flux (Btu/hr-ft <sup>2</sup> )	Conductivity (K) (Btu/hr-ft-°F)	Conductance (C) (Btu/hr-ft <sup>2</sup> -°F)	VAC
<b>AL H/C 3/16-003-2 (VAC) T0070N</b>								
446	437	18	1.9813	109.0	334.6	3.07	18.59	30u
526	516	20		121.1	388.7	3.21	19.44	15u
621	608	26		157.5	537.1	3.41	20.65	15u
710	692	36		218.0	747.7	3.43	20.77	15u
<b>AL H/C 1/4-003-2 (VAC) T0081N</b>								
300	293	14	1.9815	84.78	196.69	2.32	14.05	65u
462	452	20		121.12	276.15	2.28	13.81	43u
541	527	28		169.57	434.10	2.56	15.50	40u
622	606	32		193.79	525.17	2.71	16.41	30u
708	687	42		254.35	745.25	2.93	17.74	25u
<b>AL H/C 1/8-003-2 (VAC) T0110</b>								
530	518	24	1.982	145.31	661.16	4.55	27.55	30u
610	596	28		169.53	806.96	4.76	28.82	20u
698	683	30		181.63	844.58	4.65	28.15	20u
<b>AL H/C 1/8-001-1 0055N</b>								
-26.05	-48.68	45.26	0.98025	552.09	853.53	1.546	19.29	
-173.7	-219.53	91.66		1143.51	1332.19	1.165	14.54	
-224.5	-255.60	62.2		781.30	848.49	1.086	13.55	
-274.8	-290.03	30.46		436.08	423.86	0.972	12.13	
140	130.5	19.0	0.981	465.25	448.36	0.9637	23.60	
320	302.0	36.0		881.52	968.79	1.099	26.91	
460	439.5	41.0		1003.95	1122.71	1.183	28.97	
595	573	44.0		1077.41	1370.46	1.272	31.15	
<b>AL H/C 1/8-001-1 0072N</b>								
-33.05	-53.20	40.30	0.98025	502.82	779.37	1.55	19.34	
-181.05	-224.30	86.50		1079.28	1270.30	1.177	14.68	
-238.75	-267.53	57.56		718.03	756.08	1.053	13.14	
-280.55	-295.37	29.64		370.62	386.18	1.042	13.00	
145	135.9	18.2	0.980	222.86	427.89	1.920	23.50	
358	345.1	25.8		315.92	715.56	2.265	27.72	
480	465.4	29.2		357.56	857.07	2.397	29.33	
518	501.4	33.2		406.53	1003.72	2.469	30.22	
<b>AL H/C 1/8-001-3/8 0054N</b>								
-61.70	-74.70	30	0.36175	905.93	1293.67	1.428	49.76	
.75	-97.80	8.1		282.23	390.04	1.382	48.15	
-250.70	-272.48	43.56		1517.42	1561.43	1.029	35.85	
-278.90	-292.43	27.06		942.51	901.04	0.956	33.31	
130	125.1	9.8	0.3563	330.06	491.46	1.489	51.64	
305	291.4	27.2		916.08	1499.62	1.637	56.77	
435	417	36		1212.46	2109.68	1.740	60.34	
540	518.1	43.8		1475.16	2730.52	1.851	64.19	
<b>AL H/C 1/8-001-3/8 0071N</b>								
-70.70	-81.10	20.80	0.36175	724.74	1015.36	1.401	48.82	
-102.65	-103.50	1.70		59.24	97.27	1.642	57.21	
-258.65	-277.50	37.70		1313.59	1318.84	1.004	34.98	
-286.80	-297.48	21.36		743.90	714.14	0.960	33.45	
128	122.9	10.30	0.364	339.56	512.74	1.510	49.79	
328	312.5	30.8		1015.38	1728.17	1.702	56.12	
420	399.11	41.8		1358.24	2523.60	1.858	61.26	
540	517.7	44.6		1470.33	2971.54	2.021	66.63	
<b>AL H/C 1/4-003-3/8 0050N</b>								
-63.95	-76.28	24.66	0.3545	883.51	1060.21	1.200	43.01	
-88.10	-92.45	8.70		311.83	381.06	1.222	43.80	
-246.00	-269.50	47.00		1684.59	1596.99	0.948	33.98	
-272.25	-286.20	27.90		1000.00	927.00	0.927	33.23	
150	145.2	9.6	0.3547	324.73	505.92	1.558	52.70	
435	420.5	29		811.83	1315.16	1.620	54.80	
565	549	32		980.97	1660.78	1.693	57.27	
				1082.45	1970.06	1.820	61.56	

TABLE XVIII (Cont'd)

Hot Face (°F)	Avg Temp (°F)	ΔT (°F)	Thickness (in.)	Gradient (°F/ft)	Heat Flux (Btu/hr-ft²)	Conductivity (K) (Btu/hr-ft°F)	Conductance (C) (Btu/hr-ft²-°F)
<u>AL H/C 3/16-003-3/8 T0065N</u>							
-101.40	-102.78	2.76	0.358	100.72	1107.90	1.615	57.07
-292.70	-300.78	16.16	0.358	570.67	578.09	1.013	35.80
140	134.6	10.68	0.361	356.93	511.48	1.433	47.64
460	448.97	22.06		737.27	1344.04	1.823	60.61
590	577.74	24.52		819.48	1673.37	2.042	67.89
<u>AL H/C 3/16-001-3/8 0045N</u>							
-48.70	-58.18	18.96	0.354	674.85	582.39	0.863	30.73
-188.45	-193.15	9.40		2115.38	1459.40	0.689	24.56
-270.80	-278.77	15.94		568.02	401.59	0.707	25.18
178	170	16	0.3553	539.32	602.95	1.118	37.79
348	333	30		1011.23	1232.68	1.219	41.21
475	458	34		1146.06	1528.84	1.334	45.09
618	600	36		1213.48	1785.03	1.471	49.73
<u>AL H/C 3/16-001-3/8 0046N</u>							
-43.25	-53.60	20.70	0.354	737.18	644.29	0.874	31.13
-179.45	-212.60	66.30		2361.11	1544.16	0.654	23.29
-276.80	-283.15	12.70		452.28	335.13	0.741	26.38
180	172	16	0.356	539.32	598.10	1.109	37.39
350	335	30		1011.23	1191.22	1.178	39.71
475	458	34		1146.06	1469.24	1.282	43.22
610	591	38		1280.89	1811.17	1.414	47.67
<u>AL H/C 3/16-001-1 0041N</u>							
-11.3	-35.05	47.50	0.98475	591.35	591.35	1.000	12.47
-64.95	-74.93	19.96		248.69	240.98	0.969	12.08
-189.30	-230.65	82.70		1031.01	812.44	0.788	9.83
-212.30	-245.28	65.96		822.17	648.69	0.789	9.83
150	135	30.0	0.9895	363.636	496.363	1.365	16.54
370	348	44.0		533.333	862.399	1.617	19.20
485	461	48.0		581.818	1035.054	1.779	21.56
625	600	50.0		606.060	1273.332	2.101	25.47
<u>AL H/C 3/16-001-1 0044N</u>							
-50.3	-64.37	28.14	0.98475	352.17	339.49	0.946	12.02
-144.90	-200.58	111.36		1388.23	1131.40	0.815	10.16
-172.70	-218.30	90.20		1136.98	919.82	0.809	10.09
-226.35	-253.93	55.16		699.99	566.29	0.809	10.09
165	154	22.0	0.9825	268.565	389.956	1.452	17.72
335	317	36.0		439.470	724.686	1.649	20.13
490	468	44.0		537.1	967.3	1.801	21.99
654	625	50.0		610.376	1120.650	1.836	22.41
<u>AL H/C 1/4-003-2 T0061N</u>							
-54.1	-75.25	42.3	1.9858	258.54	533.63	2.064	12.59
-85.1	-93.38	16.76		100.92	205.27	2.034	12.40
-124.25	-206.95	165.4		1003.54	1744.15	1.738	10.60
-157.60	-226.43	137.66		839.33	1398.32	1.666	10.16
145	130.8	28.32	1.9868	171.05	437.37	2.557	15.44
328	302.7	50.8		306.82	879.96	2.868	17.32
470	441.9	56.2		339.44	1069.24	3.150	19.03
608	578.2	59.6		359.98	1227.89	3.411	20.60
<u>AL H/C 1/4-003-2 T0062N</u>							
-74.3	-87.45	26.30	1.9858	160.98	324.86	2.018	12.30
-96.1	-100.10	8.00		98.78	106.39	2.154	13.13
-146.05	-220.18	148.26		903.97	1503.30	1.663	10.14
-181.70	-240.20	117.00		713.41	1174.99	1.647	10.04
155	143.6	22.8	1.9845	137.87	371.97	2.698	16.31
350	336.5	27.0		163.27	490.79	3.006	18.17
493	477.4	31.2		188.66	624.84	3.312	20.02
608	578.7	58.6		354.35	1262.90	3.564	21.55

**TABLE XVIII (Cont'd)**

Hot Face (° F)	Avg Temp (° F)	ΔT (° F)	Thickness (in.)	Gradient (° F/ft)	Heat Flux (Btu/hr-ft <sup>2</sup> )	Conductivity (K) (Btu/hr-ft <sup>-2</sup> °F)	Conductance (C) (Btu/hr-ft <sup>2</sup> °F)
<u>AL H/C 1/4-003-1 0052N</u>							
-44, 20	-65, 95	43, 5	0.981	543, 07	1282, 19	2, 361	29, 48
-79, 55	-88, 75	18, 4		230, 34	393, 88	1, 710	21, 35
-194, 60	-243, 13	97, 06		1211, 61	1613, 86	1, 332	16, 63
-245, 00	-272, 88	55, 76		696, 05	851, 97	1, 224	15, 28
145	135, 5	19, 0	0.983	231, 88	459, 81	1, 983	24, 20
322	303, 2	37, 6		458, 88	1004, 48	2, 189	26, 71
478	457	42, 0		512, 58	1229, 16	2, 398	29, 26
595	572, 6	44, 8		546, 75	1377, 81	2, 520	30, 75
<u>AL H/C 1/4-003-1 0053N</u>							
-70, 00	-82, 58	25, 16	0.981	313, 98	521, 83	1, 662	20, 75
-96, 10	-100, 33	8, 46		105, 50	174, 81	1, 657	20, 69
-227, 60	-263, 85	72, 50		905, 12	1149, 50	1, 270	15, 86
-266, 70	-287, 60	41, 80		521, 85	624, 65	1, 197	14, 94
142	131, 9	20, 2	0.9835	246, 46	486, 27	1, 973	24, 07
328	309, 7	36, 6		446, 56	981, 98	2, 199	26, 83
450	426	48, 0		585, 66	1419, 64	2, 424	29, 58
590	563, 3	53, 4		651, 55	1702, 50	2, 613	31, 88
<u>AL H/C 3/16-003-3/8 T0064N</u>							
-88, 30	-93, 23	9, 86	0.358	348, 06	523, 83	1, 505	53, 18
-275, 80	-285, 88	20, 16	0.358	712, 02	1107, 90	1, 556	54, 98
145	140, 5	9, 0	0.362	298, 34	451, 09	1, 512	50, 13
340	333, 2	13, 6		450, 82	693, 36	1, 538	50, 99
480	471, 9	16, 2		537, 02	896, 82	1, 670	55, 37
610	600, 3	19, 4		643, 09	1151, 13	1, 790	59, 35
<u>AL H/C 1/8-003-3/4 T0094N</u>							
145	140, 0	10	0.736	163, 04	452, 27	2, 774	45, 25
323	311, 0	24		391, 30	1180, 94	3, 018	49, 23
435	417, 0	36		586, 96	1993, 90	3, 397	55, 41
568	554, 0	38		619, 57	2292, 40	3, 700	60, 35
<u>AL H/C 1/4-0015-3/8 T0091N</u>							
153	147, 0	12	0.357	403, 64	376, 59	0, 933	31, 39
330	312, 0	26		874, 56	847, 44	0, 969	32, 60
470	454, 0	32		1076, 38	1149, 57	1, 068	35, 93
605	587, 0	36		1210, 93	1451, 90	1, 199	40, 34
<u>AL H/C 1/4-0015-3/8 T0102N</u>							
155	149, 0	12	0.355	405, 29	391, 91	0, 967	32, 66
335	323, 0	24		810, 58	847, 05	1, 045	32, 30
475	460, 0	30		1013, 22	1137, 84	1, 123	37, 90
608	591, 0			1148, 32	1388, 31	1, 209	40, 84
<u>AL H/C 1/4-0015-1 T0101N</u>							
152	137	30	0.983	366, 18	368, 01	1, 005	11, 27
338	317	42		512, 65	811, 52	1, 583	17, 76
485	463	44		537, 06	909, 78	1, 694	19, 00
620	597	96		561, 47	1005, 59	1, 791	20, 09
<u>AL H/C 1/4-0015-1 T0103N</u>							
150	138	24	0.983	292, 90	384, 27	1, 316	16, 06
340	320	40		488, 17	719, 56	1, 474	17, 99
488	466	44		536, 99	850, 59	1, 584	19, 33
<u>AL H/C 1/4-0015-2 T0104N</u>							
140	125	30	1.985	181, 36	275, 30	1, 518	9, 17
335	314	42		253, 90	450, 16	1, 773	10, 71
488	465	46		278, 08	550, 87	1, 981	11, 97
610	585	50		302, 26	651, 37	2, 155	13, 02
<u>AL H/C 1/4-0015-2 T0105N</u>							
143	129	28	1.982	169, 52	289, 20	1, 706	10, 33
335	316	38		230, 07	451, 28	1, 962	11, 88
480	458	44		266, 39	571, 94	2, 147	13, 00
608	585	46		278, 50	663, 10	2, 381	14, 42
<u>AL H/C 3/16-0015-3/4 T0082N</u>							
145	138	14	0.7345	228, 72	436, 85	1, 910	31, 20
320	308	24		392, 10	843, 79	2, 152	35, 16
470	456	28		457, 45	1112, 51	2, 432	39, 73
605	588	34		555, 47	1449, 22	2, 609	42, 62

**TABLE XVIII (Cont'd)**

Hot Face (*F)	Avg Temp (*F)	$\Delta T$ (*F)	Thickness (in.)	Gradient (*F/ft)	Heat Flux (Btu/hr-ft <sup>2</sup> )	Conductivity (K) (Btu/hr-ft <sup>-2</sup> *F)	Conductance (G) (Btu/hr-ft <sup>2</sup> *F)
<u>AL H/C 3/16-003-3/4 0093N</u>							
145	137	16	0.7332	261.86	399.86	1.527	24.99
320	308	24		392.79	848.81	2.161	35.36
475	462	26		425.53	1074.04	2.524	41.30
608	594	28		458.26	1263.42	2.757	45.12
<u>AL H/C 3/16-001-1 1/2 T0085N</u>							
120	109.4	21.2	1.4785	172.07	252.77	1.469	11.924
350	338	24		194.79	414.12	2.126	17.257
485	472.4	25.2		204.53	575.74	2.812	22.825
618	601.7	32.6		264.59	757.52	2.863	23.239
<u>AL H/C 3/16-001-1 1/2 T0084N</u>							
122	111.3	21.4	1.4795	173.57	261.57	1.507	12.23
340	231	38		308.21	534.13	1.733	14.07
485	465	40		324.43	625.50	1.928	15.65
618	596	43.8		355.26	739.29	2.081	16.89
<u>AL H/C 1/4-003-3/4 T0088N</u>							
145	138.20	13.6	0.7317	223.04	373.59	1.675	27.47
320	305	30		492.00	1001.71	1.77	29.00
455	435.29	39.4		646.17	1291.35	1.999	32.78
590	568.50	43.2		708.49	1579.93	2.230	36.57
<u>AL H/C 1/4-003-3/4 T0089N</u>							
138	131	14	0.73175	229.58	368.93	1.607	26.35
320	304.5	31		508.37	958.27	1.885	30.91
460	442.5	35		573.97	1180.65	2.057	33.73
590	571.2	37.6		616.60	1391.04	2.256	36.99
<u>AL H/C 1/8-003-3/4 T0090N</u>							
150	147.0	6	0.736	97.82	338.45	3.46	56.41
330	327.0	14		228.25	808.00	3.54	57.71
463	453.0	20		326.08	1222.80	3.75	61.14
590	579.0	22		358.68	1423.95	3.97	64.73
<u>AL H/C 1/8-0015 T</u>							
184	171	26	0.735	424.49	925.81	2.181	35.61
284	264	40		653.06	1635.92	2.505	40.90
368	346	44		718.37	1915.89	2.667	42.54
463	440	46		751.02	1999.22	2.662	43.46
566	542	48		783.67	2150.39	2.744	44.80
<u>AL H/C 1/8-0015 T</u>							
208	197	22	0.732	360.66	731.42	2.028	33.25
298	281	34		557.38	1199.48	2.152	35.28
400	381	38		622.95	1409.74	2.263	37.10
482	461	42		688.52	1699.96	2.469	40.48
580	558	44		721.31	1958.36	2.715	44.51
<u>AL H/C 1/8-0015 T</u>							
-254	-262	16	0.733	261.94	423.30	1.616	26.46
-200	-220	24		392.91	684.22	1.737	28.44
-82	-85	6		98.23	169.35	1.724	28.22
-56	-62	12		196.45	394.47	2.008	32.87
-36	-43	14		229.20	471.46	2.057	33.68
<u>AL H/C 3/16-001 011N, Q to Cells to Node Bond Line</u>							
151.0	150.0	2.0	0.733	16.6	25.8	1.55	25.2
281.5	276.1	10.8		95.6	146.9	1.54	25.0
397.0	390.0	14.0		124.0	182.1	1.47	23.9
445.5	437.4	16.3		144.0	226.1	1.57	25.5
564.3	555.3	18.0		159.4	271.5	1.70	27.7

TABLE XVIII (Cont'd)

Hot Face (°F)	Avg Temp (°F)	ΔT (°F)	Thickness (in.)	Gradient (°F/ft)	Heat Flux (Btu/hr-ft²)	Conductivity (K) (Btu/hr-ft²-°F)	Conductance (C) (Btu/hr-ft²-°F)	VACUUM
<u>S162 T0112N</u>								
-187.5	-239.0	103.0	1.131	1098.7	25.68	0.0235		
-187.0	-239.0	104.0		1104.0	25.83	0.0234		
-183.5	-236.5	106.0		1141.2	25.67	0.0225		
76.3	-111.1	374.8		3928.9	71.11	0.0181		
-148.2	-221.8	146.2		1548.8	18.28	0.0118		
-47.0	-171.2	248.4		2643.0	30.76	0.0149		
10.4	-4.45	29.7		817.4	15.53	0.0190		
+11.5	-28.3	33.6		360.9	6.35	0.0176		
+11.6	-26.4	29.6		359.8	6.48	0.0180		
231.5	114.0	235.0		1247.4	26.19	0.0210		
74.2	65.4	17.6		181.5	3.99	0.0220		
120.6	88.4	64.4		661.4	14.55	0.0220		
196.0	127.5	137.0		1452.0	32.09	0.0221		
249.3	154.5	189.6		1993.6	45.25	0.0227		
646.7	360.8	571.8		6096.6	161.54	0.0265		
473.5	269.8	407.4		4313.2	103.51	0.0240		
872.6	474.2	796.2		8429.9	239.41	0.0284		
869.2	470.8	796.8		8411.9	239.73	0.0285		
725.3	398.2	645.2		6923.6	190.40	0.0275		
986.2	657.5	657.4		7261.2	233.81	0.0322		
977.3	648.9	656.8		7205.9	234.91	0.0326		
<u>S162 VACUUM T0113N</u>								
	39.2	148.2	1.131	1565.8	1.25	0.0008		$40 \times 10^{-3}$
247.2	107.5	279.4		2979.0	2.08	0.0007		$60 \times 10^{-3}$
132.6	0.6	264.0		2803.0	1.40	0.0005		$190 \times 10^{-3}$
219.5	73.5	292.0		3067.9	1.53	0.0005		$35 \times 10^{-3}$
113.3	-87.2	401.0		2128.5	0.85	0.0004		$300 \times 10^{-3}$
121.0	-83.1	408.2		4352.0	1.74	0.0004		$300 \times 10^{-3}$
77.5	-104.8	364.6		3880.0	0.39	0.0001		$300 \times 10^{-3}$
88.2	1.8	180.0		1854.6	0.74	0.0004		$2.4 \times 10^{-3}$
187.6	76.5	222.2		2388.5	1.91	0.0008		$8.0 \times 10^{-3}$
<u>NRC-2 Multilayer Foil Insulation 500/1/2-In. 0097N</u>								
-152.0	-221.25	138.5	0.495	3357.58	56.071	$16.7 \times 10^{-3}$	0.400	
-161.5	-226.25	129.5		3146.46	52.231	$16.6 \times 10^{-3}$	0.398	
-69.0	-84.375	30.75		745.45	16.772	$22.5 \times 10^{-3}$	0.540	
-64.0	-80.9	33.8		824.24	35.772	$43.4 \times 10^{-3}$	1.041	
<u>NRC-2 Multilayer Foil Insulation 500/1/4-In. 0098</u>								
50.5	43.0	15.0	0.243	703.70	46.725	$66.4 \times 10^{-3}$	3.187	
-58.5	-80.0	43.0		2135.80	84.15	$39.4 \times 10^{-3}$	1.891	
-56.25	-79.0	45.5		2234.57	88.712	$39.7 \times 10^{-3}$	1.906	
-189.25	-247.6	116.7		5716.05	183.48	$32.1 \times 10^{-3}$	1.541	
-182.75	-243.4	121.3		5987.66	196.39	$32.9 \times 10^{-3}$	1.574	
<u>NRC-2 Multilayer Foil Insulation 250/1/2-In. 0099</u>								
-43.75	-71.5	55.5	0.495	1351.51	18.110	$13.4 \times 10^{-3}$	0.3217	
-46.00	-71.5	51.0		1236.36	21.389	$17.3 \times 10^{-3}$	0.4152	
-171.5	-240	137.0		333.34	50.33	$15.1 \times 10^{-3}$	0.3624	
-151.5	-229	155.0		3745.46	60.676	$16.2 \times 10^{-3}$	0.3888	
68.1	55.8	24.6		596.97	12.43	$35.9 \times 10^{-3}$	0.8617	
<u>NRC-2 Multilayer Foil Insulation 250/1/4-In. 0100</u>								
	-209.25	191.5	0.243	9456.80	196.701	$20.8 \times 10^{-3}$	0.9986	
	-61.6	76.2		3765.40	82.086	$21.8 \times 10^{-3}$	1.046	
-10.0	-54.25	88.5		4370.35	100.96	$23.1 \times 10^{-3}$	1.1089	
55.0	46.6	16.8		827.15	33.582	$40.6 \times 10^{-3}$	1.949	
55.0	46.25	18.5		913.55	37.729	$41.3 \times 10^{-3}$	1.983	
<u>Teflon T123</u>								
132.4	106.8	51.3	0.471	1311.4	178.4	0.136		
216.4	189.8	53.2		1360.4	190.5	0.140		
299.6	273.0	53.3		1361.5	189.2	0.139		
363.3	337.5	51.6		1319.0	187.3	0.142		
457.7	431.0	53.4		1365.4	188.4	0.138		

TABLE XVIII (Cont'd)

Hot Face (* F)	Avg Temp (* F)	$\Delta T$ (* F)	Thickness (in.)	Gradient (* F/ft)	Heat Flux (Btu/hr-ft <sup>2</sup> )	Conductivity (K) (Btu/hr-ft <sup>-2</sup> * F)	Conductance (C) (Btu/hr-ft <sup>2</sup> - * F)	VAC
<u>Teflon T124</u>								
146.8	112.0	69.6	0.486	1719.6	208.1	0.121		
210.4	180.0	60.8		1500.5	189.1	0.126		
290.6	262.0	57.2		1411.6	189.2	0.134		
372.0	344.5	55.0		1359.1	191.6	0.141		
468.4	440.0	56.8		1403.8	190.9	0.136		
<u>Polyethylene T357</u>								
120	100	20	0.494		108.6	0.224		
174	151	23		559	121.3	0.217		
	196	24		583	120.1	0.206		
<u>TG 15000 T0037N (VAC)</u>								
258	227	62	0.103			9.6x10 <sup>-4</sup>		
362	332	60				11.2x10 <sup>-4</sup>	35u	
472	441	62				12.8x10 <sup>-4</sup>	35u	
599	570	58				9.1x10 <sup>-4</sup>	43u	
608	579	58				6.2x10 <sup>-4</sup>	33u	
715	684	42				2.9x10 <sup>-4</sup>	37u	
738	700	76				23.4x10 <sup>-4</sup>	37u	
759	722	74				16.1x10 <sup>-4</sup>	25u	
819	785	48				28.4x10 <sup>-4</sup>	25u	
935	897	76				54.9x10 <sup>-4</sup>	38u	
<u>TG 15000 T0079N (VAC)</u>								
252	221	62	0.103			6.3x10 <sup>-4</sup>		
358	325	66				8.4x10 <sup>-4</sup>	2.3x10 <sup>-5</sup>	
445	412	66				16.5x10 <sup>-4</sup>	1.5x10 <sup>-5</sup>	
542	511	62				28.5x10 <sup>-4</sup>	1.1x10 <sup>-5</sup>	
							1.0x10 <sup>-5</sup>	
<u>Boat Protective Cover T0055N</u>								
300	274.7	50.6	0.31315	1939.00	81.05	0.0418	1.602	
420	391.6	56.8		2176.59	67.26	0.0309	1.184	
620	589.2	61.6		2360.53	59.25	0.0251	0.962	
<u>Boat Protective Cover T0059N</u>								
175	152.4	45.2	0.316	1716.46	86.50	0.0504	1.9141	
350	324.5	51.0		1936.71	81.73	0.0422	1.6027	
430	403.5	53.0		2012.65	74.47	0.0370	1.4052	
580	551.1	57.8		2194.94	60.58	0.0276	1.0482	
<u>NRC-2 Multilayer Foil Insulation 50 Layers 0095N</u>								
-250.5	-272.0	43.0	0.04992	10336.54	242.908	23.5x10 <sup>-3</sup>	5.649	
-235.75	-261.75	52.0		12560.1	280.09	22.3x10 <sup>-3</sup>	5.361	
-78.75	-87.25	17.0		4627.4	141.14	30.5x10 <sup>-3</sup>	7.332	
42.00	36.5	11.0		1502.41	79.18	52.7x10 <sup>-3</sup>	12.67	
<u>NRC-2 Multilayer Foil Insulation 500/In. 0096N</u>								
-214.0	-262.6	97.2	0.9970	1168.20	102.217	87.5x10 <sup>-4</sup>	2.100	
-217.5	-264.5	94.0		1129.16	104.898	92.9x10 <sup>-4</sup>	2.222	
-217.5	-261.5	88.0		1135.17	106.478	93.8x10 <sup>-4</sup>	1.051	
3.75	-44.5	96.5		1159.22	22.488	19.4x10 <sup>-3</sup>	0.466	
6.25	-44.0	100.5		1210.24	21.542	17.8x10 <sup>-3</sup>	0.427	
-35.0	-66.9	63.8		765.80	12.023	15.7x10 <sup>-3</sup>	0.376	
117.25	79.0	76.5		915.97	31.051	33.9x10 <sup>-3</sup>	0.813	
114.5	77.0	75.0		909.95	31.096	34.2x10 <sup>-3</sup>	0.820	
91.25	4.75	173.0		2090.18	40.340	19.3x10 <sup>-3</sup>	0.463	
<u>Phenolic Laminated Fiberglass T511</u>								
127	106	42	0.501	1006.0	243.4	0.242		
210	186	48		1150.0	293.2	0.255		
275	248	54		1293.4	335.0	0.259		
345	318	54		1293.4	347.9	0.269		
443	415	56		1341.3	281.7	0.210		

TABLE XVIII (Cont'd)

Hot Face (°F)	Avg Temp (°F)	ΔT (°F)	Thickness (in.)	Gradient (°F/ft)	Heat Flux (Btu/hr-ft²)	Conductivity (K) (Btu/hr-ft²-°F)	Conductance (C) (Btu/hr-ft²-°F)
<u>Phenolic Laminated Fiberglass T543</u>							
132	108	48	0.476	1210.1	273.5	0.226	
215	189	52		1310.9	313.3	0.239	
283	255	56		1411.8	344.5	0.244	
358	330	56		1411.8	347.3	0.246	
<u>HT 424 T598</u>							
170	148	44	0.500	1056.0	439.3	0.416	
245	219	52		1248.0	559.1	0.448	
325	298	54		1296.0	568.9	0.439	
410	382	56		1344.0	637.0	0.474	
498	470	56		1344.0	655.9	0.488	
590	561	58		1392.0	637.5	0.458	
<u>HT 424 T526</u>							
-177	-197	41	0.500	1014.4	271.8	0.268	
152	128	48	0.485	1187.6	530.0	0.446	
188	163	50		1237.1	571.5	0.462	
250	224	52		1286.6	612.4	0.476	
318	291	54		1336.1	648.0	0.485	
428	400	56		1385.6	713.6	0.515	
-87	-121	67		1657.7	487.4	0.294	
<u>HT 424 T525</u>							
-208	-226	37	0.485	915.4	222.4	0.243	
-123	-156	65		1608.2	431.0	0.268	
150	126	48		1187.6	484.5	0.408	
188	164	48		1187.6	502.3	0.423	
250	224	52		1286.5	566.1	0.440	
317	291	52		1286.5	597.0	0.464	
382	355	54		1336.0	648.0	0.485	
<u>HT 424 T600</u>							
180	158	44	0.500	1056.0	457.2	0.433	
250	224	52		1248.0	564.1	0.452	
330	303	54		1296.0	615.6	0.475	
510	481	58		1392.0	583.2	0.519	
600	570	60		1440.0	747.4		
<u>Sylgard 182-2 T604</u>							
160	133	54	0.410	1580.5	151.7	0.096	
240	213	54		1580.5	148.6	0.094	
320	292	56		1639.1	149.2	0.091	
405	376	58		1697.7	146.0	0.086	
490	461	58		1697.7	140.9	0.083	
565	535	60		1756.2	145.8	0.083	
<u>Sylgard 182-2 T610</u>							
165	138	54	0.445	1456.2	142.7	0.098	
245	217	56		1510.1	140.4	0.093	
325	296	58		1564.0	145.4	0.093	
410	381	58		1564.0	142.3	0.091	
490	461	58		1564.0	132.9	0.085	
570	540	60		1618.0	140.8	0.087	
<u>Sylgard 182-2 T524</u>							
-230	-255	49	0.445	1180.7	99.2	0.084	
165	140	50	0.498	1204.8	113.2	0.094	
240	214	52		1253.0	119.0	0.095	
304	277	54		1301.1	122.3	0.094	
375	347	56		1349.4	125.5	0.093	
398	369	58		1397.6	128.6	0.092	
-10	-97	165		3975.8	417.5	0.105	
<u>Sylgard 182-2 T523</u>							
-246	-271	49	0.498	1289.5	95.4	0.074	
170	145	50	0.456	1315.8	115.8	0.088	
248	221	54		1421.1	123.6	0.087	
318	290	56		1473.7	122.3	0.083	
399	370	58		1526.3	120.6	0.079	
420	391	58		1526.3	120.6	0.079	
-86	-154	137		3605.4	349.7	0.097	

**TABLE XIX**  
**DATA TABULATION PRESSURE DROP EXPERIMENTS-AVCOAT-5026-39**

Flowmeter No.	Scale Reading	Q (cm <sup>3</sup> /min)	P <sub>L</sub>	P <sub>H</sub>	P <sub>H</sub> -P <sub>L</sub>	Pressure Drop (lb/in <sup>2</sup> )
<b>5026-39HCG-P Virgin Parallel Flow Re: Cell Walls</b>						
<b>Initial Checkout: Dry Air 75.4°F (s = 0.00119)</b>						
08-1/16-08-4	6. 6 3. 8 2. 55 5. 25 7. 20 8. 0	26. 5 6. 0 1. 5 15. 0 33. 5 43. 5	43. 9 W 44. 1 W 44. 2 W 44. 05 W 43. 90 W 43. 80 W	44. 6 W 44. 4 W 44. 35 W 44. 50 W 44. 65 W 44. 75 W	0. 70 0. 30 0. 15 0. 45 0. 75 0. 95	0. 00996 0. 00427 0. 00214 0. 00641 0. 0107 0. 0135
08-1/16-16-4	4. 10 5. 1 7. 1 6. 1 6. 00 9. 2 8. 9 12. 0 13. 6 14. 8 15. 4	14. 5 22. 0 44. 5 33. 0 31. 0 75. 5 71. 0 122. 0 151. 5 174. 0 185. 0	44. 10 W 44. 0 W 43. 95 W 44. 0 W 44. 0 W 43. 75 W 43. 75 W 43. 45 W 43. 20 W 43. 05 W 43. 00 W	44. 45 W 44. 50 W 44. 60 W 44. 60 W 44. 60 W 44. 85 W 44. 85 W 45. 20 W 45. 40 W 45. 60 W 45. 65 W	0. 35 0. 50 0. 65 0. 60 0. 60 1. 10 1. 10 1. 75 2. 20 2. 55 2. 65	0. 00498 0. 00712 0. 00926 0. 00854 0. 0157 0. 0249 0. 0313 0. 0363 0. 0377
02-1/8-12-5	2. 2 3. 7 4. 7 6. 3 7. 85 8. 80 9. 90 11. 15 11. 60	37. 0 122. 0 210. 0 355. 0 510. 0 610. 0 730. 0 870. 0 917. 0	43. 95 W 43. 40 W 42. 80 W 41. 80 W 40. 60 W 40. 10 W 39. 20 W 38. 10 W 37. 95 W	44. 65 W 45. 25 W 45. 90 W 47. 00 W 48. 25 W 48. 80 W 49. 80 W 50. 95 W 40. 40 Hg	0. 70 1. 85 3. 10 5. 20 7. 65 8. 70 10. 60 12. 85 13. 20	0. 00997 0. 0263 0. 0441 0. 0740 0. 1089 0. 124 0. 151 0. 183 0. 188
2F-1/4-20-5	6. 4 8. 8 10. 00 12. 00 14. 00 16. 00 18. 00 20. 0	2100. 0 3250. 0 3850. 0 4860. 0 5900. 0 6950. 0 8050. 0 9100. 0	29. 95 W 38. 95 Hg 24. 80 W 38. 60 Hg 17. 95 W 38. 05 Hg 10. 60 W 37. 50 Hg 36. 95 Hg 36. 50 35. 90 Hg 35. 30 Hg	59. 65 W 41. 05 Hg 65. 10 W 41. 45 Hg 72. 30 W 41. 75 Hg 80. 10 W 42. 50 Hg 43. 10 Hg 43. 55 44. 10 Hg 44. 70 Hg	29. 70 2. 10 40. 30 2. 85 54. 35 3. 90 69. 50 5. 00 6. 15 7. 05 8. 20 9. 40	0. 423 0. 405 0. 574 0. 550 0. 774 0. 753 0. 990 0. 965 1. 187 1. 36 1. 58 1. 81
<b>5026-39HCG-P Virgin Parallel Cell Walls</b>						
<b>High Flow Checkout: Dry Air at 74.8°F, (Barometer: 772.3 mm 30.40 24 °C 75 °C )</b>						
2F-1/4-20-5-70	7. 0 8. 0 9. 0 10. 0 11. 0 12. 0 13. 0 14. 0 15. 0 16. 0 17. 0 18. 0 19. 0 20. 0 15. 00 10. 0	2400 2850 3350 3850 4350 4850 5375 5900 6425 6975 7500 8075 8600 9100 6425 3850	38. 85 Hg 43. 50 W 38. 60 Hg 43. 45 W 38. 30 Hg 43. 35 W 38. 10 Hg 43. 25 W 37. 80 Hg 43. 10 W 37. 50 Hg 43. 00 W 37. 20 Hg 42. 80 W 36. 95 Hg 42. 65 W 36. 65 Hg 42. 50 W 36. 40 Hg 42. 30 W 36. 10 Hg 42. 10 W 35. 80 Hg 41. 85 W 35. 50 Hg 41. 60 W 35. 20 Hg 41. 35 W 36. 65 Hg 42. 50 W 38. 10 Hg 43. 25 W	41. 15 Hg 45. 0 W 41. 40 Hg 45. 05 W 41. 70 Hg 45. 15 W 41. 90 Hg 45. 25 W 42. 20 Hg 45. 40 W 42. 50 Hg 45. 50 W 42. 80 Hg 45. 70 W 43. 05 Hg 45. 85 W 43. 35 Hg 46. 00 W 43. 60 Hg 46. 15 W 43. 90 Hg 46. 30 W 44. 20 Hg 46. 50 W 44. 50 Hg 46. 80 W 44. 80 Hg 47. 00 W 43. 35 Hg 46. 00 W 41. 90 Hg 45. 25 W	2. 30 Hg 1. 50 W 2. 80 Hg 1. 60 W 3. 40 Hg 1. 80 W 3. 88 Hg 2. 00 W 4. 40 Hg 2. 30 W 5. 00 Hg 2. 50 W 5. 60 Hg 2. 90 W 6. 10 Hg 3. 20 W 6. 70 Hg 3. 50 W 7. 20 Hg 3. 85 W 7. 80 Hg 4. 20 W 8. 40 Hg 4. 65 W 9. 00 Hg 5. 20 W 9. 60 Hg 5. 65 W 6. 70 Hg 3. 50 W 3. 80 Hg 2. 00 W	0. 444 0. 021* 0. 540 0. 023* 0. 656 0. 026* 0. 733 0. 028* 0. 849 0. 033* 0. 965 0. 036* 1. 081 0. 041* 1. 18 0. 046* 1. 29 0. 050* 1. 39 0. 055* 1. 51 1. 18 0. 060* 1. 62 0. 066* 1. 74 0. 074* 1. 85 0. 080* 1. 29 0. 050* 0. 733 0. 028*

\*Downstream pressure differential above barometric

**TABLE XVIII (Concl'd)**

Hot Face (°F)	Avg Temp (°F)	ΔT (°F)	Thickness (in.)	Gradient (°F/ft)	Heat Flux (Btu/hr-ft <sup>2</sup> )	Conductivity (K) (Btu/hr-ft <sup>-2</sup> °F)	Conductance (C) (Btu/hr-ft <sup>2</sup> °F)
<b>Sylgard 182-2 T373</b>							
-237	-264	54	0.456	1370.0	104.1	0.076	
175	150	50	0.473	1268.5	111.6	0.088	
244	218	52		1319.2	109.5	0.083	
314	287	54		1370.0	112.3	0.082	
390	361	58		1471.5	111.8	0.076	
418	389	58		1471.5	113.3	0.077	
-36	-119	167		4236.8	406.7	0.096	
	-113	165		4186.0	401.8	0.096	
<b>Epon 931 T082</b>							
114	97	35	0.500	840.0	161.3	0.192	
192	176	32		768.0	169.0	0.220	
264	249	30		720.0	172.1	0.239	
345	330	30		720.0	172.1	0.239	
446	431	29		696.0	170.5	0.245	
<b>RTV 560 T903</b>							
-36	-84	96	0.490	2351.0	500.8	0.213	
66	-10	152		3722.5	766.8	0.206	
166	144	44		1077.6	198.3	0.184	
257	233	48		1175.5	203.4	0.173	
330	305	50		1224.5	198.4	0.162	
430	404	52		1273.5	185.9	0.146	
<b>RTV 560 T902</b>							
-38	-86	96	0.480	2400.0	508.8	0.212	
77	-1	156		3900.0	830.7	0.213	
165	142	46		1150.0	215.0	0.187	
255	231	48		1200.0	208.8	0.174	
330	305	50		1250.0	207.5	0.166	
425	400	50		1250.0	186.2	0.149	
<b>Cork A6400 T00024</b>							
198	177	42	0.505	997.9	49.9	0.050	
275	251	48		1140.5	53.6	0.047	
362	336	52		1235.5	59.3	0.048	
438	413	50		1188.0	53.5	0.045	
<b>Purple Blend T375</b>							
164	141	46	0.500	1104.0	81.7	0.074	
222	198	48		1152.0	85.2	0.074	
296	272	48		1152.0	89.8	0.078	
380	355	50		1200.0	93.6	0.078	
463	438	54		1296.0	106.3	0.082	
<b>Purple Blend T376</b>							
128	103	50	0.498	1205.0	81.9	0.068	
193	167	52		1253.2	90.2	0.072	
266	240	52		1253.2	92.7	0.074	
342	315	54		1301.4	100.2	0.077	
430	402	56		1349.6	102.6	0.076	
<b>Epoxy Laminated Fiberglass T515</b>							
-175	-206	62	0.500	1488.0	229.2	0.154	
-64	-122	116		2784.0	490.0	0.176	
137	114	46		1104.0	241.8	0.219	
210	185	50		1200.0	270.0	0.225	
273	246	54		1296.0	291.6	0.225	
342	315	54		1296.0	291.6	0.225	
380	352	56		1344.0	302.4	0.225	
<b>Epoxy Laminated Fiberglass T517</b>							
-180	-210	60	0.502	1434.0	196.5	0.137	
-71	-129	116		2772.4	432.5	0.156	
132	109	46		1099.4	248.5	0.226	
217	192	50		1195.0	283.2	0.237	
286	260	52		1242.8	299.5	0.241	
360	333	54		1290.6	326.5	0.253	
443	415	56		1338.4	356.1	0.266	
490	462	56		1338.4	351.9	0.263	
575	546	58		1386.2	368.7	0.266	
<b>Epoxy Laminated Fiberglass T576</b>							
-181	-208	55	0.501	1317.2	200.2	0.152	
-65	-116	102		2442.9	439.7	0.180	
180	154	52		1245.4	265.3	0.213	
260	233	54		1293.3	267.7	0.207	
352	325	54		1293.3	265.1	0.205	
445	417	56		1341.2	297.7	0.222	
540	511	58		1389.1	344.5	0.248	
612	583	58		1389.1	362.6	0.261	
<b>Epoxy Laminated Fiberglass T576</b>							
-179	-208	59	0.501	1413.0	230.3	0.163	
-61	-115	107		2562.6	484.3	0.189	
175	149	52		1245.4	300.1	0.241	
250	223	54		1293.3	327.2	0.253	
345	318	54		1293.3	349.2	0.270	
440	412	56		1341.2	368.8	0.275	
535	506	58		1389.1	382.0	0.275	
600	571	58		1389.1	398.7	0.287	

TABLE XIX (Cont'd)

Calibration Curve	Scale Reading X2	Q (cm <sup>3</sup> /min)	P <sub>L</sub> (cm Hg)	P <sub>H</sub> (cm Hg)	(cm H <sub>2</sub> O) X6	(cm H <sub>2</sub> O) X7	P <sub>H</sub> -P <sub>L</sub> (cm H <sub>2</sub> O)	P <sub>H</sub> -P <sub>L</sub> (cm H <sub>2</sub> O)	Down Stream Pressure (lb/in <sup>2</sup> )	P <sub>BAR</sub> (mm Hg)	Gas Temp (°F) X9	Pressure Drop (lb/in <sup>2</sup> Hg)	Pressure Drop (lb/in <sup>2</sup> H <sub>2</sub> O)	
<u>2026-.391 CG-P Virgin Flow Perf to Cell Walls</u>														
L = 0.50 in. D = 2.00 in.														
Air = 0.00122 Air = 0.01833 Cp														
08G-1/16-08-4/36	6.90	27.5	48.70	51.20	33.10	68.50	2.50	35.40	14.93	772.0	76 °F	0.48	0.504	
• 4.50	3.20	49.80	50.10	47.35	52.95	5.30	5.60	0.30	12.60	0.164	0.164	0.060	0.060	
6.40	9.5	49.55	50.40	44.00	56.60	0.85	1.60	26.40	3.00	0.367	0.367	0.179	0.179	
7.60	34.2	49.00	50.90	37.40	63.80	1.90	40.60	0.60	50.60	0.579	0.579	0.376	0.376	
08F-1/16-16-4/36	5.90	30.0	48.2	51.45	30.55	71.15	3.00	40.60	0.60	50.60	0.579	0.579	0.376	0.376
Use only X4 and X5 for P	7.60	51.0	48.90	51.00	49.75	76.10	3.70	50.25	0.25	0.714	0.714	0.715	0.715	
8.50	72.5	47.00	52.20	49.70	50.20	2.10	0.45	14.93	14.93	0.405	0.405	15.34	15.34	
9.20	75.5	46.20	53.70	49.65	50.25	4.50	0.55	14.93	14.93	0.866	0.866	15.80	15.80	
9.65	83.0	45.80	54.20	49.65	50.30	7.50	0.65	14.93	14.93	1.14	1.14	16.07	16.07	
11.7	117.0	42.90	57.00	5	50.30	8.40	0.65	14.93	14.93	1.45	1.45	16.38	16.38	
13.80	155.5	43.00	56.95	56.95	14.10	13.95	1.30	14.93	14.93	1.62	1.62	16.55	16.55	
15.30	18.30	41.10	58.85	49.55	50.40	17.75	0.85	14.93	14.93	2.72	2.72	17.65	17.65	
15.70	37.70	62.25	49.50	50.50	24.55	1.00	14.93	14.93	2.69	2.69	17.62	17.62		
02F-1/8-12-5/36	4.1	155	40.75	59.20	49.60	50.35	18.45	0.75	14.93	14.93	3.42	3.42	16.35	16.35
Use only X4 and X5 for P	4.3	36.85	63.10	49.55	50.45	50.45	26.25	0.90	14.93	14.93	4.73	4.73	19.66	19.66
4.7	20.8	32.30	67.70	49.50	50.45	35.40	0.90	14.93	14.93	5.06	5.06	19.99	19.99	
5.5	28.0	23.80	76.35	49.45	50.50	52.75	1.05	14.94	14.94	6.84	6.84	21.77	21.77	
5.95	28.5	22.25	78.10	49.45	50.50	55.55	1.05	14.94	14.94	10.18	10.18	25.12	25.12	
6.00	32.5	18.30	82.25	49.45	50.50	63.95	1.05	14.94	14.94	10.88	10.88	25.72	25.72	
6.10	33.6	16.20	84.50	49.45	50.50	68.30	0.95	14.94	14.94	12.34	12.34	27.25	27.25	
6.30	35.5	13.55	87.30	49.45	50.50	73.75	0.90	14.94	14.94	13.18	13.18	28.12	28.12	
6.55	38.0	10.40	90.70	49.45	50.50	80.30	0.90	14.94	14.94	14.23	14.23	29.17	29.17	
6.95	42.0	6.55	94.90	49.45	50.50	86.35	0.90	14.94	14.94	15.50	15.50	30.44	30.44	
7.05	43.0	4.80	96.80	49.45	50.50	92.00	1.05	14.94	14.94	17.76	17.76	31.99	31.99	
Decreasing Flow	6.95	4.20	15.20	85.55	7.35									
6.20	34.5	12.20	79.30	50.50	58.10									
5.30	26.5	29.55	64.90	49.45	50.50	40.95								
4.70	21.0	34.10	60.20	49.45	50.50	30.80	1.05	14.92	14.92	11.21	11.21	26.15	26.15	
4.10	15.5	39.75	60.35	49.45	50.50	20.45								
14.05	16.0	39.60	60.35	49.45	50.50	20.75								
12.10	124	44.10	55.85	53.40	55.85	11.75								
9.80	85.5	46.50	52.35	48.55	51.35	6.90								
7.60	39.2	47.50	51.35	49.75	50.20	4.85								
6.20	22.2	48.55	42.70	48.00	42.70	2.80								
4.15	7.5													

**TABLE XIX (Cont'd)**

Flow Meter No.	Scale Reading	(ft <sup>3</sup> /min)	Flow (cm <sup>3</sup> /min)	P <sub>L</sub>	P <sub>H</sub>	P <sub>H</sub> -P <sub>L</sub>	Pressure (lb/in <sup>2</sup> )
<b>5026-39HCG-P Virgin Parallel Flow</b>							
<b>High Flow Checkout</b>							
Dry Air at 74.8 °F							
75.4 °F (Air Temp)	20.0	0.50	$1.416 \times 10^4$	33.05 Hg	46.95 Hg	13.90 Hg	2.68
	25.0	0.620	$1.76 \times 10^4$	41.10 W	47.20 W	61.0 W	0.087*
	30.0	0.740	$2.10 \times 10^4$	31.30 Hg	48.70 Hg	17.40 Hg	3.36
	35.0	0.870	$2.46 \times 10^4$	41.00 W	47.30 W	63.0 W	0.070*
	40.0	0.990	$2.80 \times 10$	25.90 Hg	50.50 Hg	20.95 Hg	4.04
	45.0	1.110	$3.14 \times 10^4$	40.80 W	47.50 W	67.0 W	0.095*
	50.0	1.240	$3.51 \times 10^4$	22.45 Hg	52.40 Hg	24.70 Hg	4.77
	55.0	1.360	$3.85 \times 10^4$	39.85 W	40.65 W	70.0 W	0.100*
	60.0	1.480	$4.19 \times 10^4$	20.70 Hg	54.05 Hg	28.35 Hg	5.47
	65.0	1.610	$4.56 \times 10^4$	39.50 W	40.40 W	74.0 W	0.105*
78.0 °F (Air Temp)	70.0	1.730	$4.90 \times 10^4$	18.80 Hg	47.80 W	56.05 Hg	6.16
	75.0	1.850	$5.24 \times 10^4$	39.15 W	49.00 W	79.5 W	0.113*
	80.0	1.980	$5.61 \times 10^4$	19.10 Hg	40.10 W	75.80 Hg	8.82
	85.0	2.100	$5.95 \times 10^4$	19.00 Hg	41.35 Hg	84.5 W	0.120*
	85.0	2.100	$5.95 \times 10^4$	17.25 Hg	42.20 Hg	91.0 W	0.130*
	90.0	2.220	$6.29 \times 10^4$	38.80 W	49.30 W	42.75 Hg	8.25
	95.0	2.350	$6.66 \times 10^4$	17.35 Hg	43.10 Hg	49.50 Hg	9.55
	75.0	1.850	$5.24 \times 10^4$	15.50 Hg	45.00 Hg	11.45 W	0.163*
	55.0	1.360	$3.85 \times 10^4$	38.30 W	49.75 W	49.20 Hg	9.50
	25.0	0.620	$1.76 \times 10^4$	15.65 Hg	44.85 Hg		
<b>5026-39HCG-P Virgin Parallel Flow</b>							
<b>Recheck of Low Flow Rate Region: Dry Air at 75.4 °F</b>							
<b>P<sub>BAR</sub> 761.3 mm 24 °C</b>							
08F-1/16-08-4	3.45		4.3	49.55	49.60	0.05	0.00071
	4.40		9.0	49.50	49.65	0.15	0.0021
	6.15		22.0	49.40	49.75	0.35	0.0043
	6.60		26.5	49.35	49.80	0.42	0.0060
	7.50		36.8	49.30	49.90	0.60	0.0085
	8.00		43.2	49.25	49.95	0.70	0.010
	6.00		20.5	49.40	49.75	0.35	0.0050
	6.20		22.2	49.40	49.75	0.35	0.0050
	4.40		9.0	49.50	49.65	0.15	0.0021
	3.10		3.0	49.55	49.60	0.05	0.00071
	3.00		2.5	49.55	49.60	0.05	0.0071
	4.40		9.0	49.50	49.65	0.15	0.0021
	5.30		15.0	49.45	49.75	0.30	0.0043
	6.20		22.2	49.40	49.80	0.40	0.0057
	7.30		34.2	49.35	49.85	0.50	0.0071
	7.85		41.5	49.30	49.90	0.60	0.0085

TABLE XIX (Cont'd)

(X12)M 28.97															
Flow Meter Calibration Curve X1	Sc. Iw Reading X2		Q (cm <sup>3</sup> /min) X3	P <sub>L</sub> (cm Hg) X4	P <sub>H</sub> (cm Hg) X5	P <sub>L</sub> (cm H <sub>2</sub> O) X6	P <sub>H</sub> (cm H <sub>2</sub> O) X7	P <sub>Bar</sub> (mm Hg) X8	Gas Temp (° F) X9	P (X5) - (X4) (cm Hg)	P(H <sub>2</sub> O) (X7) - (X6) Cm H	Sample Press Drop (lb/in. <sup>2</sup> )	Down Stream Pressure (lb/in. <sup>2</sup> )	Up Stream Pressure (lb/in. <sup>2</sup> )	
<b>5026-39HCG-P Flow Parallel to Cell Walls</b>															
Material Precharged at 1380° F L(X10) = 0.500 in., D(X11) = 1.78 in.															
<b>O2F-1/8-12-5/36</b>															
1.8			25			49.95	50.00	775.9	76.0		0.05	0.00071		15.00	15.00
2.1			33			49.95	50.05			0.10	0.0014				
3.7			122			49.90	50.10			0.20	0.0028				
4.5			192			49.90	50.10			0.20	0.0028				
5.65			295			49.80	50.20			0.40	0.0056				15.01
7.3			455			49.70	50.30			0.60	0.0085				15.01
8.8			610			49.60	50.40			0.80	0.0114				
9.55			690			49.50	50.50			1.00	0.0142				15.01
10.80			832			49.45	50.55			1.10	0.0157				15.02
11.1			865			49.40	50.60			1.20	0.0171				15.02
<b>2F-1/4-20-5/36</b>															
6.8			2300			48.30	51.85			3.55	0.0506				15.05
8.3			3000			47.80	52.46			4.60	0.0655				15.06
9.1			3420			47.35	52.85			5.50	0.0783				15.08
10.1			3900	49.75	50.15	46.95	53.35			0.40	6.40	0.0911			15.09
11.0			4350	49.70	50.20	46.60	53.75			0.50	7.15	0.102			15.10
12.8			5280	49.65	50.25	45.80	54.60			0.60	8.80	0.125			15.12
13.0			5380	50.30	45.70	54.70				0.70	9.00	0.128			15.13
15.5			6700	49.55	50.35	44.65	55.90			0.80	11.25	0.160			15.16
16.9			7580	49.50	50.40	43.95	56.65			0.90	12.70	0.181			15.18
18.3			8200	49.50	50.45	43.25	57.40			0.95	14.15	0.201			15.20
18.3			8200								14.15	0.201			
19.9			9080	49.40	50.50	42.50	58.25			1.10	15.75	0.224			15.22
<b>B4-21-10/27</b>															
14.0	0.35	0.99	49.40	50.50	42.50	58.20				1.10	15.70	0.224			15.41
18.8	0.465	1.32				39.30	61.70			2.20	22.40	0.319	15.09		15.52
24.1	0.600	1.70	48.85	51.05	35.45	65.85				2.80	30.40	0.433			15.65
30.0	0.745	2.11	48.55	41.35	31.30	70.60				2.80	39.30	0.560			15.76
35.0	0.865	2.45	48.25	51.65	27.30	74.50				3.50	47.20	0.672			15.88
40.0	0.990	2.80	47.95	51.95	23.45	78.60				4.00	55.15	0.785	15.10		15.89
						23.30	78.70				55.40	0.789			
<b>Use only Hg for P (P<sub>H</sub><sub>2</sub>O for down-stream differential)</b>															
45.0	1.110	3.14	47.65	52.25	45.90	53.60				76.0	4.60	0.888			15.99
50.0	1.24	3.51	47.35	52.55	45.60	53.90					5.20	1.01			16.13
55.0	1.36	3.85	47.05	52.90	45.25	54.30					5.85	1.13			16.26
60.0	1.48	4.19	46.70	53.20	44.90	54.60					6.50	1.25			16.39
65.0	1.605	4.54	46.40	53.50	44.50	55.00					7.10	1.37			16.52
70.0	1.73	4.90	46.05	53.85	44.05	55.35				77.0	7.80	1.51			16.67
<b>5026-39HCG-P 1380° F Prechar Flow Parallel to Cells</b>															
<b>B4-21-10/27</b>															
70.0	1.73	4.90	46.00	53.90	43.95	55.40				77.4	7.90	1.52			16.68
<b>Use only for Hg for P</b>															
75.0	1.85	5.24	45.70	54.20	43.50	55.80					8.50	1.64			16.82
80.0	1.97	5.58	45.40	54.55	43.10	56.30					9.15	1.77			16.96
85.0	2.10	5.95	45.00	54.90	42.40	56.90					9.90	1.91			17.12
90.0	2.22	6.29	44.70	55.25	42.00	57.30					10.55	2.04			17.26
95.0	2.35	6.66	44.40	55.55	41.40	57.80					11.15	2.15			17.38
100.0	2.47	7.00	44.05	55.90	40.90	58.30					11.85	2.29			17.54
<b>Black Particles Present (Slightly) in and about the Flow Meter</b>															
<b>B-35-10/27</b>															
10.0	2.80	7.93	43.40	56.55	42.20	57.00				77.0	13.15	2.54			17.75
15.0	4.10	1.61	39.50	60.50	40.30	58.60					21.00	4.05			19.31
17.0	4.70	13.31	37.55	62.40	39.40	59.60					24.85	4.80			20.09
19.0	5.25	14.87	35.80	64.15	38.20	60.55					28.35	5.47			20.79
20.0	5.50	15.58	35.10	64.90	37.80	60.95					27.80	5.75			21.08
22.0	6.05	17.13	33.40	66.60	36.60	62.00					33.20	6.41			21.77
24.0	6.60	18.69	31.60	68.35	35.35	63.20					36.75	7.09			22.49
25.0	6.90	19.54	30.70	69.35	34.60	63.90					38.65	7.46			22.88
26.0	7.15	20.25	29.70	70.35	33.85	64.55					40.65	7.84			23.28
28.0	7.70	21.81	28.05	72.10	32.30	65.90					44.05	8.50			23.98
30.3	8.30	23.50	26.35	73.85	30.75	67.30					47.50	9.17			24.69
32.0	8.80	24.92	24.30	76.00	28.80	69.05					51.70	9.98			25.55
34.0	9.35	26.48	22.45	77.95	26.60	71.00					55.50	10.71			26.34
36.0	9.95	28.18	20.45	80.00	24.75	72.55					59.55	11.49			26.68
38.0	10.45	29.59	18.40	82.20	22.30	74.30					63.80	12.31			27.17
40.0	11.00	31.15	16.90	83.80	20.75	76.15					66.90	12.91			27.74
42.0	11.60	32.85	14.10	86.60	17.50	79.00					72.50	13.92			28.05
42.5	11.70	33.13	14.35	86.50	18.00	78.70					72.15	13.92			28.78
41.9	11.50	32.57	15.10	85.60	18.90	78.00					70.50	13.61			29.45
44.0	12.10	34.27	12.95	87.90	16.00	80.5					74.95	14.46			30.38
42.9	11.80	33.42	14.00	86.80	17.5	79.0					72.80	14.05			29.93

TABLE XIX (Cont'd)

Flow Meter Calibration Curve X1	Scale Reading x2	$\dot{Q}$ ( $\text{cm}^3/\text{min}$ ) x3	$P_L$ ( $\text{cm Hg}$ ) x4	$P_{H_2O}$ ( $\text{cm H}_2\text{O}$ ) x5	$P_H$ ( $\text{cm Hg}$ ) x6	$P_L$ ( $\text{cm H}_2\text{O}$ ) x7	Gas Temp ( $^{\circ}\text{F}$ ) x9	$P_{H_2O}$ ( $\text{cm H}_2\text{O}$ ) x8	Down Stream $P_{H_2O}$ ( $\text{cm H}_2\text{O}$ )	Down Stream Pressure (lb/in. <sup>2</sup> )	Sample P (lb/in. <sup>2</sup> )	Up Stream Pressure (lb/in. <sup>2</sup> abs)	
<u>5026-39 C.G.P., Precharged at 1380°F, Flow Parallel to Cell Walls</u>													
<u>Keran Fluid: Dry Air</u>													
<u>(X1) L = 0.500 in.</u>													
<u>(X11) D = 1.78 in.</u>													
<u>(X12) M = 28.97</u>													
02F-1/8-12.5/36	3.25	92			49.90	50.02	75.0			14.74	0.0017	14.74	
	9.15	648			49.52	50.40					0.012	14.73	
	11.55	913			49.30	50.70					0.020	14.76	
2F-1/4-20-5/36	5.7	1760			48.70	51.30					0.037	14.76	
	10.8	4250			46.70	53.50					0.097	14.85	
	15.5	6700			44.60	55.70					0.158	14.91	
	18.5	8320			43.10	57.45					0.204	14.95	
	20.0	9100			42.35	58.25	75.0				0.226	14.98	
3F-3/8-25-5/36	8.0	$8.95 \times 10^3$			42.00	58.70					0.238	14.99	
	11.0	$1.78 \times 10^4$			38.00	63.00					0.356	15.12	
	14.0	$1.78 \times 10^4$			33.25	68.10					0.496	15.26	
	18.0	$2.39 \times 10^4$			31.70	68.90					0.682	15.44	
	22.0	$3.01 \times 10^4$			48.20	51.70					0.894	15.66	
	25.0	$3.50 \times 10^4$			47.65	52.25					1.042	15.82	
<u>C FM C/C/MIN</u>													
B4-21-10/70	20.0	$0.493 \cdot 1.175 \times 10^4$	49.16	50.85			75.8	46.70	52.80	14.83	0.338	15.17	
	40.0	$0.987 \cdot 2.350 \times 10^4$	47.95	51.95				46.00	53.45	14.85	0.772	15.62	
	60.0	$1.480 \cdot 3.526 \times 10^4$	46.70	53.20				44.75	54.60	14.88	1.254	16.13	
	80.0	$1.974 \cdot 4.79 \times 10^4$	45.40	54.50				42.90	56.25	14.93	1.756	16.69	
	100.0	$2.467 \cdot 5.876 \times 10^4$	44.05	55.90				40.55	58.30	14.99	2.287	17.28	
B6-35-10/27	15.0	$4.166 \cdot 9.26 \times 10^4$	39.45	60.45			76.4	40.45	58.45	15.00	4.053	19.05	
	20.0	$5.555 \cdot 1.323 \times 10^5$	35.00	65.00				38.00	60.65	15.06	5.190	20.85	
	30.0	$8.333 \cdot 1.985 \times 10^5$	26.00	74.25				26.40	70.10	15.36	9.312	24.52	
	35.0	$9.721 \cdot 2.316 \times 10^5$	21.10	79.35							11.242	26.60	

TABLE XIX (Concl'd)

Flow Meter Calibration Curve XI	Scale Reading X2	Q (cm <sup>3</sup> /min) X3	P <sub>H</sub> (cm Hg) X4	P <sub>L</sub> (cm H <sub>2</sub> O) X6	P <sub>H</sub> (cm H <sub>2</sub> O) X7	Temp (*F) X9	Gas Down Stream P <sub>L</sub> (cm H <sub>2</sub> O)	Down Stream P <sub>H</sub> (cm H <sub>2</sub> O)	Pressure Down Stream P <sub>H</sub> (cm H <sub>2</sub> O)	Sample (lb/in. <sup>2</sup> ) P	Up Stream Pressure (lb/in. <sup>2</sup> abs)
<u>5026-39HCC-P, Precharged to 1380°F. Flow Perpendicular to Cell Walls Fluid-Dry Air</u>											
<u>(X8) P<sub>BAR</sub> = 762.8 mm (Hg)</u>											
<u>(X11) D = 1.75 in.</u>											
<u>(X12) M = 28.97</u>											
<u>Wt Before Test 23.2 gms</u>											
<u>Wt After Test 23.2 gms</u>											
08F-1/16-1614/36	10.6	98	49.80	50.10	49.60	50.15	49.65	50.15	49.60	0.0043	14.74
	13.0	140	49.60	50.15	49.60	50.20	49.55	50.25	49.60	0.0078	14.75
	13.1	142	49.60	50.15	49.60	50.20	49.55	50.25	49.60	0.0071	14.75
	14.0	159	49.60	50.20	49.60	50.25	49.55	50.25	49.60	0.0100	14.75
	15.0	177	49.60	50.25	49.60	50.25	49.55	50.25	49.60	0.0100	14.75
02F-1/8-12-5/36	4.25	172	49.55	50.25	49.55	50.25	49.55	50.25	49.55	0.010	14.75
	5.0	238	49.40	50.40	49.45	50.70	48.40	51.50	49.40	0.014	14.75
	6.0	325	48.95	50.95	48.95	51.50	48.40	51.50	48.95	0.022	14.76
	7.1	435	48.95	51.50	48.95	51.50	48.40	51.50	48.95	0.028	14.77
	8.2	548	48.65	51.25	48.65	51.25	48.40	51.50	48.65	0.037	14.78
	9.4	675	48.40	51.50	48.40	51.50	48.40	51.50	48.40	0.044	14.78
	10.75	825	48.05	51.90	48.05	51.90	47.80	52.15	48.05	0.055	14.80
	11.70	930	47.80	52.15	47.80	52.15	45.55	54.65	47.80	0.062	14.80
2F-1/4-20-5/36	6.0	19.2x10 <sup>3</sup>	54.55	54.65	54.55	75.4	33.90	66.30	74.8	0.062	14.87
	7.0	2.40x10 <sup>3</sup>	44.50	55.85	44.50	55.85	42.05	58.55	44.50	0.130	14.90
	8.0	2.86x10 <sup>3</sup>	43.35	57.10	43.35	57.10	40.70	59.95	43.35	0.162	14.90
	9.0	3.35x10 <sup>3</sup>	40.55	58.55	40.55	58.55	39.30	61.50	40.55	0.196	14.94
	10.0	3.85x10 <sup>3</sup>	40.70	59.95	40.70	59.95	38.00	62.95	40.70	0.235	14.98
	11.0	4.35x10 <sup>3</sup>	41.15	60.30	41.15	60.30	36.35	64.70	41.15	0.274	15.01
	12.0	4.86x10 <sup>3</sup>	41.50	61.50	41.50	61.50	34.90	67.80	41.50	0.316	15.06
	13.0	5.37x10 <sup>3</sup>	41.90	62.95	41.90	62.95	33.20	69.60	41.90	0.355	15.10
	14.0	5.90x10 <sup>3</sup>	42.35	71.15	42.35	71.15	31.50	73.00	42.35	0.404	15.20
	15.0	6.43x10 <sup>3</sup>	42.70	73.00	42.70	73.00	29.80	75.00	42.70	0.447	15.24
	16.0	6.96x10 <sup>3</sup>	43.15	75.15	43.15	75.15	28.10	77.00	43.15	0.488	15.28
	17.0	7.50x10 <sup>3</sup>	43.60	76.50	43.60	76.50	26.40	78.80	43.60	0.530	15.32
	18.0	8.08x10 <sup>3</sup>	43.35	75.55	43.35	75.55	24.70	79.00	43.35	0.582	15.36
	19.0	8.60x10 <sup>3</sup>	43.20	75.00	43.20	75.00	23.00	79.80	43.20	0.638	15.40
	20.0	9.10x10 <sup>3</sup>	43.05	74.85	43.05	74.85	21.30	79.00	43.05	0.688	15.44
3F-3/8-25-5/36	8.0	8.9x10 <sup>-3</sup>	47.90	51.95	23.20	78.65	75.4	75.4	75.4	0.743	15.49
	10.0	1.18x10 <sup>4</sup>	47.20	52.70	13.70	88.70	48.80	50.95	48.80	1.720	15.55
	12.0	1.48x10 <sup>4</sup>	46.35	53.55	32.05	65.30	48.95	50.75	48.95	1.750	15.83
	12.0	1.48x10 <sup>4</sup>	46.20	53.65	30.30	71.30	48.90	50.80	48.90	1.777	16.16
	13.0	1.63x10 <sup>4</sup>	45.75	54.15	28.60	73.00	48.85	50.80	48.85	1.798	16.22
	14.0	1.78x10 <sup>4</sup>	45.20	54.70	26.70	74.80	48.45	51.20	48.45	1.816	16.40
	15.0	1.93x10 <sup>4</sup>	44.70	55.20	24.80	75.00	48.80	51.20	48.80	1.834	16.61
	16.0	2.08x10 <sup>4</sup>	44.20	55.75	23.20	75.80	48.75	50.90	48.75	1.866	16.81
	17.0	2.23x10 <sup>4</sup>	43.75	56.35	21.50	76.50	48.70	50.95	48.70	1.870	17.00
	18.0	2.39x10 <sup>4</sup>	43.35	56.90	20.80	77.20	48.65	51.00	48.65	1.874	17.25
	19.0	2.54x10 <sup>4</sup>	42.35	57.55	19.20	77.80	48.60	51.05	48.60	1.883	17.46
	20.0	2.70x10 <sup>4</sup>	41.75	58.15	18.60	78.30	48.55	51.10	48.55	1.893	17.71
	21.0	2.85x10 <sup>4</sup>	41.10	58.80	18.00	78.80	48.45	51.20	48.45	1.915	17.94
	22.0	3.01x10 <sup>4</sup>	40.50	59.45	17.40	79.30	48.30	51.30	48.30	1.946	18.20
	23.0	3.17x10 <sup>4</sup>	39.85	60.10	16.80	79.80	48.20	51.40	48.20	1.977	18.44
	24.0	3.33x10 <sup>4</sup>	39.25	60.65	16.35	80.30	48.10	51.50	48.10	2.008	18.69
	25.0	3.50x10 <sup>4</sup>	38.60	61.35	15.80	80.80	48.00	51.60	48.00	2.039	18.92
B4-21-10-27	30.0	2.10x10 <sup>4</sup>	44.50	55.40	76.2	88.70	46.40	53.00	46.40	1.430	19.18
	35.00	2.45x10 <sup>4</sup>	43.10	56.75	76.2	88.70	46.20	53.20	46.20	1.479	19.18
	40.0	2.80x10 <sup>4</sup>	42.35	57.55	75.6	88.70	45.50	53.65	45.50	1.510	19.18
	45.0	3.15x10 <sup>4</sup>	40.45	59.50	75.6	88.70	45.20	54.00	45.20	1.541	19.18
	50.0	3.50x10 <sup>4</sup>	39.00	60.95	75.6	88.70	45.00	54.30	45.00	1.572	19.18
	55.0	3.85x10 <sup>4</sup>	37.50	62.45	75.6	88.70	44.80	54.60	44.80	1.603	19.18
	60.0	4.20x10 <sup>4</sup>	36.05	63.90	75.6	88.70	44.50	54.80	44.50	1.634	19.18
	65.0	4.55x10 <sup>4</sup>	34.30	65.60	75.6	88.70	44.20	55.00	44.20	1.665	19.18
	70.0	4.90x10 <sup>4</sup>	32.70	67.30	75.6	88.70	43.90	55.20	43.90	1.707	19.18
	75.0	5.25x10 <sup>4</sup>	30.55	69.50	75.6	88.70	43.60	55.40	43.60	1.748	19.18
	80.0	5.60x10 <sup>4</sup>	29.00	71.10	75.6	88.70	43.30	55.60	43.30	1.789	19.18
	85.0	5.94x10 <sup>4</sup>	27.20	73.00	75.6	88.70	43.00	55.80	43.00	1.820	19.18
	90.0	6.29x10 <sup>4</sup>	25.30	74.95	75.6	88.70	42.70	56.00	42.70	1.851	19.18
	95.0	6.64x10 <sup>4</sup>	23.45	76.85	75.6	88.70	42.40	56.20	42.40	1.882	19.18
	100.0	6.99x10 <sup>4</sup>	21.65	78.75	75.6	88.70	42.10	56.40	42.10	1.913	19.18
B6-35-10/27	10.0	7.81x10 <sup>4</sup>	16.25	84.40	76.6	88.70	41.50	57.35	41.50	1.947	19.18
	12.0	9.38x10 <sup>4</sup>	8.90	92.30	76.6	88.70	40.85	58.00	40.85	1.988	19.18